BOBBY JINDAL
GOVERNOR

PEGGY M. HATCH
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

Certified Mail No.

Agency Interest (AI) No. 157847
Activity No. PER20100004

Mr. Steven J. Rowlan
Vice President
1915 Rexford Rd
Charlotte, NC 28211

RE: Prevention of Significant Deterioration (PSD) Permit, PSD-LA-751
Consolidated Environmental Management Inc - Nucor Steel Louisiana
Consolidated Environmental Management Inc, Convent St. James Parish, Louisiana

Dear Mr. Rowlan:

Enclosed is your permit, PSD-LA-751. Construction of the proposed project is not allowed until such time as the corresponding Part 70 Operating Permit is issued.

Please be advised that pursuant to provisions of the Environmental Quality Act and the Administrative Procedure Act, the Department may initiate review of a permit during its term. However, before it takes any action to modify, suspend or revoke a permit, the Department shall, in accordance with applicable statutes and regulations, notify the permittee by mail of the facts or operational conduct that warrant the intended action and provide the permittee with the opportunity to demonstrate compliance with all lawful requirements for the retention of the effective permit.

Should you have any questions, contact Kermit Wittenburg of the Air Permits Division at (225) 219-3008.

Sincerely,

Cheryl Sonnier Nolan
Assistant Secretary

____
Date

CSN:KCW

c: US EPA Region VI

Agency Interest No. 157847

PSD-LA-751

AUTHORIZATION TO CONSTRUCT AND OPERATE A NEW FACILITY/MODIFIED MAJOR SOURCE
PURSUANT TO THE PREVENTION OF SIGNIFICANT DETERIORATION REGULATIONS IN LOUISIANA ENVIRONMENTAL REGULATORY CODE, LAC 33:III.509

In accordance with the provisions of the Louisiana Environmental Regulatory Code, LAC 33:III.509,

Consolidated Environmental Management Inc
1915 Rexford Rd
Charlotte, NC 28211

is authorized to construct the Direct Reduction Iron Plant at the Consolidated Environmental Management Inc - Nucor Steel Louisiana near

Hwy 3125, 2 Mi S of Hwy 70
Convent LA 70000

subject to the emissions limitations, monitoring requirements, and other conditions set forth hereinafter.

This permit and authorization to construct shall expire at midnight on ________________, 2012, unless physical on site construction has begun by such date, or binding agreements or contractual obligations to undertake a program of construction of the source are entered into by such date.

Signed this ________ day of ________________, 2011.

Cheryl Sonnier Nolan
Assistant Secretary
Office of Environmental Services
Louisiana Department of Environmental Quality

BRIEFING SHEET

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent, St. James Parish, Louisiana
PSD-LA-751

PURPOSE

Consolidated Environmental Management Inc., a subsidiary of Nucor Corporation was previously issued a permit to construct and operate a 6 Million Tonne (6.60 million ton) per year Pig Iron production facility on approximately 4,060+ acres of undeveloped land on the Mississippi River at about mile marker +163 just upstream of Romeville. Nucor requests in this permit, an Authorization to Construct and Initial Permit to Operate two new DRI production units at the NSLA property.

RECOMMENDATION

Approval of the proposed construction and issuance of a permit.

REVIEWING AGENCY

Louisiana Department of Environmental Quality, Office of Environmental Services, Air Permits Division

PROJECT DESCRIPTION

Nucor wishes to increase its internal production of high-quality scrap substitutes to provide raw materials for its existing fleet of electric arc furnace steel minimills. One such substitute used by the steelmaking process is direct reduced iron (DRI), also known as sponge iron. Nucor is committed to developing supplies of high-quality scrap substitutes, such as DRI, for about one-third of its raw materials mix. These clean iron products are essential for producing the high quality steels demanded by leading automobile, appliance, truck and other manufacturers in the United States.

Estimated emissions, in tons per year, are as follows:

Pollutant	Emissions DRI Plant	Emissions NSLA Plant	Total Emissions	PSD de minimis	Review required?
PM	205.22	1,166.27	1,371.49	25	yes
PM_{10}	135.56	467.39	603.03	15	yes
SO_2	28.34	2,936.86	2.965.20	40	yes
NOX	117.62	457.16	574.78	40	yes
CO	581.84	28,395.47	28.977.31	100	yes
VOC	33.94	206.72	240.66	40	yes

TYPE OF REVIEW

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Consolidated Environmental Management Inc - Nucor Steel Louisiana
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Particulate matter ($PM_{2.5}$ and PM_{10}), sulfur dioxide (SO_2), nitrogen oxide (NO_X), carbon monoxide (CO), and volatile organic compound (VOC) emissions from the proposed facility will be above PSD significance levels. Therefore, the requested permit was reviewed in accordance with PSD regulations for $PM_{2.5,}$ PM_{10}, SO_2, NO_X, CO, and VOC emissions. Emissions of LAC 33:III.Chapter 51-regulated toxic air pollutants (TAP) have been reviewed pursuant to the requirements of the Louisiana Air Quality Regulations.

BEST AVAILABLE CONTROL TECHNOLOGY

$PM/PM_{10}/PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions are above PSD significance levels and must undergo PSD analyses. The selection of control technology was based on the BACT analysis using a "top down" approach and included consideration of control of toxic materials.

Emissions Source	Source Identifiers	Proposed CO_{2e} BACT	Proposed $PM_{10}/PM_{2.5}$ BACT	Proposed NO_X BACT	Proposed SO_2 BACT	Proposed CO BACT	Proposed VOC BACT
Iron Oxide Storage and Handling	DRI-101, DRI-102, DRI-105, DRI-201, DRI-202, DRI-205	-	Fabric Filter with Enhanced Filter Media	-	-	-	-
Iron Oxide Coating Bin	DRI-103, DRI-203	-	Fabric Filter with Enhanced Filter Media	-	-	-	-
Iron Oxide Fines Storage and Handling	DRI-104, DRI-204	-	Surface Stabilizers, Wet Suppression and Minimize Handling		-	-	-
Cooling Towers	DRI-113, DRI-114, DRI-213, DRI-214	-	Cellular Drift Eliminators and Low TDS Cooling Water	-	-	-	-
Product Fines Briquetting	DRI-117	-	High-Energy Wet Scrubber	-	-	-	-
Product Loading	DRI-118	-	High-Energy Wet Scrubber	-	-	-	-

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Emissions Source	Source Identifiers	Proposed CO_{2e} BACT	Proposed $PM_{10}/PM_{2.5}$ BACT	Proposed NO_X BACT	Proposed SO_2 BACT	Proposed CO BACT	Proposed VOC BACT
Package Boiler	DRI-109, DRI-209	Good Combustion Practices	No Feasible Control	Low-NOX Burners and SCR	Low-Sulfur Fuel	Good Combustion Practices	Good Combustion Practices
Reformer / Main Flue Gas Stack	DRI-108, DRI-208	Good Combustion Practices. Acid gas separation system. Energy integration.	Fuel Cleaning by Wet Scrubber[1]	Low-NOX Burners, SCR and Low-NOX Fuel	Acid Gas Scrubbing	Good Combustion Practices	Good Combustion Practices
Acid Gas Absorption Vent	DRI-111, DRI-211	Acid gas separation system.	No Feasible Control	-	Sulfur Redox Catalyst	No Feasible Control	-
Upper Seal Gas Vent	DRI-106, DRI-206	-	Fuel Cleaning by Wet Scrubber[1]	-	-	-	-
Furnace Dedusting	DRI-107, DRI-207	-	High-Energy Wet Scrubber	-	-	-	-
Product Storage Silo	DRI-112, DRI-212	-	High-Energy Wet Scrubber[1]	-	-	-	-
Product Storage and Handling	DRI-115, DRI-116,	-	High-Energy Wet Scrubber	-	-	-	-
Hot Flare	DRI-110, DRI-210	-	Fuel Cleaning by Wet Scrubber[1]	Low-NOX Fuel	No Feasible Control	Good Combustion Practices	Good Combustion Practices

[1] The seal gas and fuel cleaning is on the spent reducing gas stream prior to use as fuel in the combustion chamber of the Reformer or as seal gas

AIR QUALITY IMPACT ANALYSIS

Prevention of Significant Deterioration regulations require an analysis of existing air quality for those pollutants emitted in significant amounts from a proposed facility. The analysis of ambient air impacts was conducted through air dispersion modeling usually AERMOD. Based on estimated maximum potential emissions, the proposed plant will be subject to Prevention of Significant Deterioration (PSD) review for SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$.

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Based on the initial screening modeling, which considered emissions only from the DRI facility, maximum ground level concentrations of NO_2, SO_2, CO, and Pb are below the ambient significance levels and preconstruction monitoring exemption levels. Therefore, no preconstruction monitoring, increment analysis, or refined modeling is required for these pollutants. PM_{10} and $PM_{2.5}$ were above the modeling significance levels; therefore, refined modeling was conducted for these pollutants. The refined modeling demonstrated compliance with the NAAQS and PSD increment at all receptor locations.

NAAQS Analysis

Pollutant	Averaging Period	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration	National Ambient Air Quality Standard (NAAQS)	Calculated Maximum Ground Level Concentration (all sources plus background)
$PM_{2.5}$	24-hour	1.2 μg/m³	0.65 μg/m³	35 μg/m³	25.9 μg/m³ [a]
$PM_{2.5}$	Annual	0.3 μg/m³	2.2 μg/m³	15 μg/m³	11.3 μg/m³ [a]
PM_{10}	24-hour	5 μg/m³	7.8 μg/m³	150 μg/m³	106.9 μg/m³ [a]
PM_{10}	Annual	1 μg/m³	2.4 μg/m³	50 μg/m³	46.7 μg/m³ [a]
SO_2	1-hour	8 μg/m³	2.6 μg/m³	195 μg/m³	- [b]
SO_2	3-hour	25 μg/m³	1.2 μg/m³	1,300 μg/m³	- [b]
SO_2	24-hour	5 μg/m³	0.03 μg/m³	365 μg/m³	- [b]
SO_2	Annual	1 μg/m³	0.05 μg/m³	80 μg/m³	- [b]
NO_2	Annual	1 μg/m³	0.46 μg/m³	100 μg/m³	- [b]
NO_2	1-hour	7.5 μg/m³	7.45 μg/m³ [c]	195 μg/m³	- [b]
CO	1-hour	2000 μg/m³	11.5 μg/m³	40,000 μg/m³	- [b]
CO	8-hour	500 μg/m³	21.5 μg/m³	10,000 μg/m³	- [b]
Lead	3 month rolling avg.	-	0.001 μg/m³	0.15 μg/m³	- [b]

[a] Results of the refined modeling, considering all sources plus background concentrations.
[b] Refined modeling was not required for these pollutants.
[c] This represents the result of modeling performed using both DRI and Pig Iron facility sources.

Class II PSD Increment Analysis

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Pollutant	Averaging Period	Allowed Class II PSD Increment	Modeled Class II Increment
PM_{10}	24-hour	30 $\mu g/m^3$	24.8 $\mu g/m^3$
	Annual	17 $\mu g/m^3$	-12.4 $\mu g/m^3$

Note: PSD increments for $PM_{2.5}$ will not be effective until October 20, 2011 (75 FR 64864).

ADDITIONAL IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by the proposed facility, nor will any Class I area be affected. The project will not result in any significant secondary growth effects. Approximately 150 new permanent jobs will be created during Phase I with an additional 100 jobs when Phase II is completed.

PROCESSING TIME

Application Dated:	August 20, 2010
Application Received:	August 20, 2010
Additional Information Dated:	September 24, 2010
Additional Information Dated:	October 22, 2010
Effective Completeness Date:	November 8, 2010

PUBLIC NOTICE

A notice requesting public comment on the proposed project was published in *The Advocate*, Baton Rouge, Louisiana, on <<Date>>, 200x; and in *The Enterprise*, Vacherie, Louisiana, on <<Date>>, 200x. Copies of the public notice were also mailed to individuals who have requested to be placed on the mailing list maintained by the Office of Environmental Services on <<Date>>, 200x. A proposed permit was also submitted to U.S. EPA Region VI on <<Date>>, 200x and to the Federal Land Manager on <<Date>>. All comments will be considered prior to a final permit decision.

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent St. James Parish, Louisiana
PSD-LA-751
November 8, 2010

I. APPLICANT

Consolidated Environmental Management Inc
1915 Rexford Rd
Charlotte, NC 28211

II. LOCATION

Consolidated Environmental Management Inc - Nucor Steel Louisiana is located at Hwy 3125, 2 Mi S of Hwy 70, Convent, Louisiana. Approximate UTM coordinates are 706600 kilometers East, 3329210 kilometers North, zone 15.

III. PROJECT DESCRIPTION

The DRI process reduces the iron oxide content of iron ore pellets into iron metal through direct contact with a reducing gas. The effectiveness of this reduction process is called metallization, and the process equipment will be designed to achieve a metallization rate of at least 92% of the oxides within the ore. The reduction will take place in a countercurrent vertical shaft furnace, where reducing gas passes up through iron oxide pellets, which feed through the furnace by gravity. The major elements of the DRI process include the following: (1) iron oxide preparation; (2) reducing gas creation; (3) DRI reactor shaft furnace; (4) spent reducing gas preparation for reuse, (5) DRI product handling; and (6) ancillary operations, including a package boiler, two cooling towers, and a flare for emergency situations.

Iron Oxide Preparation

Iron oxide pellets are brought to the site by ship. The iron oxide pellets are unloaded onto the existing conveying system and transferred to the stockpile area. These activities are covered by the existing NSLA permit; the following activities are covered by this application. From the stockpile, the iron oxide pellets are screened and coated with a lime reagent mixture in preparation for charging to the DRI reactor furnace. Emissions include particulate matter from the iron oxide screening, conveying and coating operations. Any excess iron oxide fines from conveying operations are transferred to the bricking plant.

Reducing Gas Preparation

Reducing gas requires preparation prior to introduction into the DRI reactor shaft furnace and much of the reactor furnace off-gas is reused in the process. Reducing gas is generated initially from natural gas, which is heated and reformed in the reformer at an elevated temperature. At this elevated temperature, the natural gas dissociates into a reducing gas rich in carbon monoxide and hydrogen, which are the primary reductants for the process:

$$CH_4 + CO_2 \rightarrow 2CO + 2H_2$$
$$CH_4 + H_2O \rightarrow CO + 3H_2$$

DRI Reactor Shaft Furnace

The DRI reactor shaft furnace is a countercurrent vertical shaft furnace, where reducing gas passed up through the iron oxide pellets, which are charged into the shaft furnace. The carbon monoxide and hydrogen of the reducing gas scavenge oxygen from the iron oxides from the iron oxide pellet charge in the shaft furnace, reducing the oxygenation state of the ores. The resulting products of the reduction process are pure iron, carbon dioxide and water:

$$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$$
$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

The rate at which these reactions occur determines the residence time needed to metallize the iron oxide pellets into DRI product, which typically takes several hours. Once the metallization process is complete, the metalized DRI pellets are cooled and discharged to the cold product pressurized discharge bins.

Emissions from the DRI reactor shaft furnace include criteria pollutants and minimal HAPs from fuel combustion and metal dust.

Spent reducing gas preparation for reuse

Once the process has initiated, spent reducing gas exits the top of the DRI reactor shaft furnace and is cooled, passed through a scrubber to remove entrained dust and excess moisture. A portion of this gas is then prepared for reuse as reducing gas by removing acid gases such CO_2, H_2S, and other reduced sulfur compounds. The reducing gas is passed through an amine absorber which strips it of the acid gas components. The cleaned reducing gas may then be adjusted with sulfur (reformer-less process) and/or natural gas prior to preheating and reforming in preparation for reintroduction into the DRI reactor shaft furnace. Oxygen injection may occur just prior to the shaft furnace to further enhance the reaction.

The acid gases removed by the amine absorption system will be passed through an iron-based catalyst bed to capture sulfur compounds. After passing through the catalyst, the resulting off-gas is near pure carbon dioxide. The captured carbon dioxide may be pipelined and sold to offsite customers. Sulfur is captured by a proprietary sulfur recovery system and is sold as a product or disposed, depending on quality and market conditions.

The second portion of the top gas leaving the furnace, hereafter referred to a the fuel gas, must be removed in order to balance the recycle loop, to prevent a buildup of CO_2 concentrations, and to recover the residual fuel value of unreacted carbon monoxide and hydrogen. After initial cleaning and cooling, discussed above, this gas is used as fuel gas for process heating.

DRI Product Handling

From the cold product pressurized discharge bins, the DRI pellets are conveyed to the DRI silos, where they may, depending upon composition, be maintained under a nitrogen and oxygen purge until cured. The finished DRI pellets are then transported by conveyor to barges and are loaded for shipment. Fines from this process, and any iron oxide fines generated from the raw iron oxide handling processes, are routed to the brick plant where they are pressed into iron bricks and sold or reused in the steel or ironmaking process.

Emissions from DRI product handling include particulates.

Ancillary Operations

Additional sources serving the DRI facility will include a package boiler, two cooling towers, and several dust collection points controlled by either a baghouse filter, or a water scrubber, or both. Several sources that were permitted in the issued PSD permit PSD-LA-749 are being transferred from the Title V permit No. 2560-00281-V0 to the Title V permit for this DRI facility. As this is an administrative move, no re-analysis for BACT is required.

Estimated emissions, in tons per year, are as follows:

Pollutant	Emissions	PSD de minimis	Review required?
PM_{10}	135.56	25/15 (PM/PM_{10})	Yes
SO_2	28.34	40	Yes
NOX	117.62	40	Yes
CO	581.84	100	Yes
VOC	33.94	40	Yes

PRELIMINARY DETERMINATION SUMMARY

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IV. SOURCE IMPACT ANALYSIS

A proposed net increase in the emission rate of a regulated pollutant above de minimis levels for new major or modified major stationary sources requires review under Prevention of Significant Deterioration regulations, 40 CFR 52.21. PSD review entails the following analyses:

A. A determination of the Best Available Control Technology (BACT);

B. An analysis of the existing air quality and a determination of whether or not preconstruction or postconstruction monitoring will be required;

C. An analysis of the source's impact on total air quality to ensure compliance with the National Ambient Air Quality Standards (NAAQS);

D. An analysis of the PSD increment consumption;

E. An analysis of the source related growth impacts;

F. An analysis of source related growth impacts on soils, vegetation, and visibility;

G. A Class I Area impact analysis; and

H. An analysis of the impact of toxic compound emissions.

A. BEST AVAILABLE CONTROL TECHNOLOGY

Under current PSD regulations, an analysis of "top down" BACT is required for the control of each regulated pollutant emitted from a modified major stationary in excess of the specified significant emission rates. The top down approach to the BACT process involves determining the most stringent control technique available for a similar or identical source. If it can be shown that this level of control is infeasible based on technical, environmental, energy, and/or cost considerations, then it is rejected and the next most stringent level of control is determined and similarly evaluated. This process continues until a control level is arrived at which cannot be eliminated for any technical, environmental, or economic reason. A technically feasible control strategy is one that has been demonstrated to function efficiently on identical or similar processes. Additionally, BACT shall not result in emissions of any pollutant which would exceed any applicable standard under 40 CFR Parts 60 and 61.

For this project, BACT analyses are required for $PM_{10}/PM_{2.5}$, SO_2, NOX, CO, and VOC emissions from the facility. Where $PM_{10}/PM_{2.5}$ is addressed in the BACT analysis, it is assumed that particulate matter (PM) is also being considered.

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In order for Nucor to develop BACT determinations, information from numerous technical sources is typically considered to identify emission limits and control technologies that apply to the types of sources being proposed for Nucor Steel Louisiana. However, in the case of $PM_{2.5}$, because the PM_{10} Surrogate Policy has been used to address $PM_{2.5}$ emissions, these resources are not as useful as they are for the other criteria pollutants and additional research was performed in order to address BACT for $PM_{2.5}$.

$PM_{2.5}$ Fabric Filter Media (Baghouse):

Recent advances in filter media for fabric filters have seen baghouses become increasingly more efficient at controlling $PM_{2.5}$ emissions from gas streams. The USEPA established the Environmental Technology Verification (ETV) program to test the control efficiency of several commercially available filter media from vendors willing to participate in the program. The ETV has demonstrated that at least 16 different advanced filter media are capable of reaching $PM_{2.5}$ removal efficiencies above 99%.

BACT DETERMINATION FOR EMISSIONS FROM IRON OXIDE STORAGE AND HANDLING

The DRI process is fed iron oxide in pellet form to provide a consistent size of material in the shaft furnace to reduce the likelihood of fused product. Iron oxide pellets are received by ship and stored in outdoor storage piles. The pellets are then reclaimed for use, and may be directed to the DRI facility, or the blast furnace stock houses. Batches of pellets directed to the DRI facility will be screened prior to storage in the Iron Oxide Day Bins. The Iron Oxide Day Bins provide a continuous feed of pellets to the shaft furnace. The continuous feed is again screened before being transferred by the furnace feed conveyor to the charge hopper at the top of the furnace.

Handling and screening of iron oxide pellets generates dust from the impacts of the pellets against themselves and against process equipment. There are no combustion sources associated with the handling of iron oxide pellets. A BACT Analysis for the control of dust emissions from sources handling iron oxide pellets is presented below.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-101 DRI Unit #1 Iron Oxide Day Bins Dust Collection (EQT0063)
DRI-201 DRI Unit #2 Iron Oxide Day Bins Dust Collection (EQT0080)
DRI-102 DRI Unit #1 Iron Oxide Screen Dust Collection (EQT0064)

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DRI-202 DRI Unit #2 Iron Oxide Screen Dust Collection (EQT0081)
DRI-105 DRI Unit #1 Furnace Feed Conveyor Baghouse (EQT0067)
DRI-205 DRI Unit #2 Furnace Feed Conveyor Baghouse (EQT0084)

Step 1 – Identify All Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression
6. Hooded Conveyors and Enclosed Transfer Stations

Fabric Filter (Baghouse):

A fabric filter or baghouse is one of the most efficient means of separating particles from a gas stream. The advantage of bag filters is that the efficiency is largely insensitive to the physical characteristics of the gas stream and changes in the dust loading. Baghouse installations are an industry standard for particulate controls.

Both positive and negative pressure baghouses have been used in the steel industry and for the handling of aggregate materials. Positive pressure baghouses operate at an internal pressure greater than atmospheric. In this configuration, the exhaust fans are located before the baghouse (i.e. "dirty side") and pull the air from the process in order to push the air through the baghouse. Treated gas is then vented to ambient air through a stack or a continuous ridge vent. Negative pressure baghouses operate at an internal pressure less than atmospheric. In this configuration, the exhaust fans are located after the baghouse (i.e. "clean side"), pull the air through the baghouse and exhaust to the ambient air through a central stack.

Enhanced Fabric Filter Media:

Local collection hoods routed to fabric filters with enhanced filter media are the most efficient means of removing $PM_{10}/PM_{2.5}$ from dusty sources. The advantage of local collection hoods and bag filters is that air flows from individual collection points in the system can be adjusted to increase or decrease collection rates, increasing the effectiveness of the system. The fabric filter is largely insensitive to spikes in dust loading that are likely to occur during iron oxide screening, transfers and other operations. For these reasons, local collection hoods and baghouse filters are the industry standard for the control of particulate from iron ore pellet handling.

Electrostatic Precipitator (ESP):

ESPs use an electrostatic field to impart a charge to particles contained in the gas stream. The charged particles then migrate to a grounded collection surface. The collection particles are then periodically dislodged from the collection surface by vibrating or rapping the collection surface. The dislodged particles are then collected in a hopper at the bottom of the ESP. ESPs are very effective at removing dust from a gas stream, but can be sensitive to variations in dust loading, or may be ineffective on materials with certain electrical properties.

Wet Scrubber:

In a wet scrubber, the gas stream is brought into contact with a scrubbing liquid, typically by spraying the liquid in a contacting tower to remove the particles, or by some other contact method. Inlet gas characteristics and dust properties are of primary importance. Wet scrubbers remove dust particles by capturing them in the liquid droplets, dissolving other pollutants in the liquid droplets, and have the ability to handle gaseous streams with high moisture content.

Cyclones:

Centrifugal collectors use cyclonic action to separate particles from the gas stream. In a typical cyclone, the gas stream enters a vessel at an angle and is spun rapidly. The centrifugal force created by the circular flow throws the particles toward the wall of the cyclone. After striking the wall, these particles fall into a hopper located beneath the cyclone. Single-cyclone separators create a dual vortex to separate coarse particles from fine. The main vortex spirals downward and carries most of the coarser dust particles. The inner vortex created near the bottom of the cyclone spirals upward and carries finer dust particles. Multiclones consist of a number of small-diameter cyclones, operating in parallel and having a common gas inlet and outlet. Multiclones operate on the same principle as cyclones by creating a main downward vortex and an ascending inner vortex. Multiclones are more efficient than single cyclones because they are longer and smaller in diameter. The longer length provides longer residence time while the smaller diameter creates greater centrifugal force. These two factors result in better separation of dust particulates. The pressure drop of multiclone collectors is higher than that of single-cyclone separators.

Wet Suppression:

Fine mists of water applied to dust generating sources, such as bulk material drop points, reduce dust emissions by impacting small particulates with water. The wetted particulate becomes heavier and quickly settles out of the air, reducing airborne dust. Alternatively, material may be thoroughly wetted prior to handling, which suppresses the generation of dust when the material is disturbed.

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Hooded Conveyors and Enclosed Transfer Stations:

Hooded conveyors are an application of partial enclosures and wind screens that are specific to conveyor systems. The conveyor hoods work to help prevent wind from lifting dust particles from materials being transported on the conveyor. Similarly, enclosed transfer stations work to isolate material drop points between conveyors from the surrounding weather conditions. Enclosed transfer stations are typically designed with minimized material drop heights to reduce dust generated by materials being transferred.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control technologies are technically feasible for the control of dusts from iron oxide storage and handling. None of the technologies identified are eliminated for technical infeasibility.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (Baghouse) – 99.5%
2. Electrostatic Precipitator (ESP) – 99.5%
3. Wet Scrubber – 99%
4. Wet Suppression – 90%
5. Cyclone – 80%
6. Hooded Conveyors and Enclosed Transfer Stations – 95% (Conveyance Only)

Potential control alternatives were ranked for effectiveness in controlling PM_{10} emissions from iron oxide storage and handling operations. Nucor has identified the highest remaining control option to be the application of either fabric filter baghouses or electrostatic precipitators PM_{10} emissions can be reduced by up to 99.5% by either of these technologies.

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (Baghouse):

Fabric filters or baghouses are an industry standard for $PM_{10}/PM_{2.5}$ control in many applications. Baghouses often are capable of 99.5% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of all particle sizes can be obtained. Baghouses can be effectively applied to most dry dust sources, but are not typically effective at very high temperatures that may burn the filter material.

Electrostatic Precipitator:

Electrostatic precipitators are common dust control devices that are good at trapping dusts within certain applications. ESPs applied to materials within the correct resistivity range can achieve very high removal efficiencies of up to 99.5%. ESPs typically have a higher initial capital cost than baghouse controls, and are more frequently used in large applications.

Wet Scrubber:

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. However, scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal that are not required for other PM_{10} control options. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, or may be most appropriate for specific materials.

Wet Suppression:

Wet suppression acts to prevent dust generation through the wetting of materials, and to settle dust more quickly by wetting the particles in air. Wet suppression can reduce the quantity of dust generated by material handling, but may hinder the operation of other control devices or process equipment.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

Hooded Conveyors and Enclosed Transfer Stations:

Hooded conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Hooded conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates or grain.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology is a fabric filter baghouse achieving at least 99.5% control of $PM_{10}/PM_{2.5}$. While an ESP may achieve similar control efficiencies, the higher initial cost makes the technology unattractive for this application. Additionally, hooded conveyors and enclosed transfer stations will be installed to limit emissions from material handling.

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BACT DETERMINATION FOR IRON OXIDE COATING BIN

Iron oxide pellets are given a light coating of pulverized limestone prior to being transferred to the furnace. The limestone coating helps to reduce the tendency of the pellets to fuse together during the reduction process. Water is added to the limestone to make a water-based slurry, which is then applied to the pellets. The pulverized limestone is periodically received by truck and pneumatically conveyed into a storage bin. The act of filling the Iron Oxide Coating Bin may generate dust emissions, including emissions of $PM_{10}/PM_{2.5}$.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-103 DRI Unit #1 Coating Bin Filter (EQT0065)
DRI-203 DRI Unit #2 Coating Bin Filter (EQT0082)

Step 1 – Identify All Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression

Step 2 – Eliminate Technically Infeasible Options

Wet Suppression:

Dust suppression through the application of water sprays are a simple way of reducing dust generation and increasing the settling rate of airborne dusts. However, water is reactive with some materials, and can be inappropriate for such applications. Water sprays would wet the pulverized limestone material being loaded into the Iron Oxide Coating Bin. The wetted limestone would have a tendency to agglomerate into larger particles and chunks. This cementation process would prevent the pulverized limestone from being slurried for its intended use, and likely clog the discharge of the coating bin itself. Wet suppression would destroy the utility of the coating, and is therefore a technically infeasible control option for the Iron Oxide Coating Bin.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric filter (baghouse) – 99.5%

2. Electrostatic Precipitator (ESP) – 99.5%
3. Wet scrubber – 99%
4. Cyclone – 80%

Potential control alternatives were reviewed for technical feasibility in controlling $PM_{10}/PM_{2.5}$ emissions from the Iron Oxide Coating Bin. Nucor has identified the highest remaining control option to be the application of either fabric filter baghouses or electrostatic precipitators $PM_{10}/PM_{2.5}$ emissions can be reduced by up to 99.5% by either of these technologies.

Step 4 – Evaluate Remaining Control Technologies

<u>Fabric Filter (baghouse):</u>

Fabric filters or baghouses are an industry standard for $PM_{10}/PM_{2.5}$ control in many applications. Baghouses often are capable of 99.5% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of all particle sizes can be obtained. Baghouses can be effectively applied to most dry dust sources, but are not typically effective at very high temperatures that may burn the filter material.

<u>Electrostatic Precipitator:</u>

Electrostatic precipitators are common dust control devices that are good at trapping dusts within certain applications. ESPs applied to materials within the correct resistivity range can achieve very high removal efficiencies of up to 99.5%. ESPs typically have a higher initial capital cost than baghouse controls.

<u>Wet Scrubber:</u>

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. However, scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal that are not required for other $PM_{10}/PM_{2.5}$ control options. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, or may be most appropriate for specific materials.

<u>Cyclones:</u>

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

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Step 5 – Selection of BACT

BACT for emissions of PM_{10} and $PM_{2.5}$ from Iron Oxide Coating Bin is selected to be local collection and control through a fabric filter employing enhanced filter media. This selection was made over an ESP control device due to the relatively small application, and intermittent use of equipment.

BACT DETERMINATION FOR EMISSIONS FROM IRON OXIDE FINES STORAGE AND HANDLING

The screening and handling of iron oxide pellets generates a quantity of undersized material referred to as fines. This material is too small to charge to the shaft furnace, where it would clog the flow of reducing gas, and contribute to the problem of pellets fusing together during the reduction reaction, and impeding the flow of pellets out of the furnace. Iron oxide fines are stored at the DRI units temporarily, until transferred as feed material to the neighboring sinter plant, on-site briquetting plant, or sold to outside buyers. The fines will be stored in an outdoor pile. Fines will typically be transferred by truck and front end loader.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-104 DRI Unit #1 Iron Oxide Fines Handling (EQT0066)
DRI-204 DRI Unit #1 Iron Oxide Fines Handling (EQT0083)

Step 1 – Identify All Control Technologies

1. Application of Surface Stabilizers to Exposed Surfaces
2. Wet Suppression
3. Minimize Handling of Materials

Application of Surface Stabilizers to Exposed Surfaces:

Chemical surface stabilizers act to agglomerate particles on the surface of the stored material, forming a crust that helps to shield the material from wind erosion. Surface stabilizers must be reapplied periodically and after rain events, as well as after disturbance of the pile surface by reclaiming of the material.

Wet Suppression:

The use of water suppression can control $PM_{10}/PM_{2.5}$ emissions by up to 90%. Water suppression may be used in general on storage piles through periodic soaking of the material, but it is most effective when a localized spray may be applied to dust generating sources, such as disturbing the pile through transferring the material.

<u>Minimize Handling of Materials:</u>

The greatest quantities of dust are generated by the act of machines moving and transferring materials. Minimizing this activity as much as possible is as effective work practice in reducing dust generation.

Step 2 – Eliminate Technically Infeasible Options

The evaluation for these control options must review whether the specific technology is available for the application and is effective at reducing $PM_{10}/PM_{2.5}$ emissions from the storage and handling of iron oxide fines. All of the above mentioned controls are technically feasible controls for reducing $PM_{10}/PM_{2.5}$ emissions from the iron oxide fines storage and handling operations.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Application of Surface Stabilizers to Exposed Surfaces – 95%
2. Wet Suppression – 90%
3. Minimize Handling of Materials – 50%

Step 4 – Evaluate Remaining Control Technologies

<u>Application of Surface Stabilizers to Exposed Surfaces:</u>

Chemical surface stabilizers are the most effective means of preventing dust generated by wind erosion from the face of the storage pile. Proper application of surface stabilizers can reduce wind erosion emission by up to 95%.

<u>Wet Suppression:</u>

Water suppression is most effective when applied locally to dust generating activities, such as material reclamation. The use of water suppression can control $PM_{10}/PM_{2.5}$ emissions by up to 90%.

<u>Minimize Handling of Materials:</u>

Machine traffic in and around material piles have the potential to generate substantial quantities of airborne dust. By limiting the frequency of handling events, emissions may be greatly reduced.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for emissions of $PM_{10}/PM_{2.5}$ from the storage and handling of iron oxide fines. Each of the technologies identified will be utilized to limit dust emissions. Nucor will control dust emissions through the application of a chemical surface stabilizer on the iron oxide storage pile. Water sprays will be used locally to control dust generation from activities such as stacking/reclaiming and pile maintenance activity. These activities will be minimized as much as practicable in order to prevent unnecessary dust emissions.

BACT DETERMINATION FOR COOLING TOWERS

Most industrial cooling towers use clarified river water or well water as their source of fresh cooling water. The cross-flow cooling towers continuously circulate cooling water through heat exchangers and other equipment where the water absorbs heat. That heat is then rejected to the atmosphere by the partial evaporation of the water in cooling towers where up-flowing air is contacted with the circulating down-flow of water. The loss of evaporated water into the air exhausted to the atmosphere is replaced by "make-up" water. Since the evaporation of pure water is replaced by make-up water containing carbonates and other dissolved salts, a portion of the circulating water is also continuously discarded as "blowdown" water to prevent the excessive build-up of salts in the circulating water.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-113 - DRI Unit #1 Process Water Cooling Tower (EQT074)
DRI-213 - DRI Unit #2 Process Water Cooling Tower (EQT091)
DRI-114 - DRI Unit #1 Clean Water Cooling Tower (EQT075)
DRI-214 - DRI Unit #1 Clean Water Cooling Tower (EQT092)

Step 1 – Identify All Control Technologies

1. High-efficiency drift eliminators
2. Low TDS cooling water

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Drift Eliminators:

Water droplets that are carried out of the cooling tower with the exhaust air are known as drift droplets. PM is created when the water evaporates from the droplet, leaving the previously dissolved salt behind as particulate matter. The drift rate is typically reduced by employing baffle-like devices, called drift eliminators, through which the air must travel after leaving the fill and spray zones of the tower. In the drift eliminators, small droplets are agglomerated into large droplets and removed from the air stream discharged from the cooling tower.

Low TDS Cooling Water:

By maintaining a low level of total dissolved solids in the circulating cooling water, the amount of particulate matter generated by the drift can be greatly reduced. A TDS concentration of 1,000 ppmv or less is typically considered to be a low concentration in cooling tower water.

A search of the U.S. EPA RBLC database was conducted to review control options for PM_{10} emissions for cooling towers in use today. The most common type of control device is a drift eliminator.

RBLC Listings for PM_{10} Emissions from Cooling Towers

Facility	**RBLC ID**	**Unit**	**Control Technology**	**Control Efficiency**	**Emission Limit**	**Units**
CLECO Power, LLC – Rodemacher Brownfield Unit 3	LA-0202	Cooling Tower (16 Cells)	Drift Eliminators	99.995 %	0.005%	Cooling Water Drift
Nucor Steel	NC-0112	Cooling Towers	Mist Eliminators	99.992 %	0.008%	Cooling Water Drift
Nucor Steel	NC-0113	Cooling Towers	Mist Eliminators	99.992 %	0.008%	Cooling Water Drift
Western Greenbrier Co-Generation, LLC	WV-0024	Cooling Tower	Drift Eliminators	99.9995 %	0.0005 %	Cooling Water Drift

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Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Great RiverEnergy – Spiritwood Station	ND-024	Cooling Tower	Drift Eliminator	99.9995 %	00005%	Cooling Water Drift

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing $PM_{10}/PM_{2.5}$ emissions from the cooling towers. BACT will be chosen as the most efficient and economical option.

High-Efficiency Drift Eliminators:

Drift eliminators are technically feasible and are able to be applied to reduce $PM_{10}/PM_{2.5}$ emissions from cooling towers. Drift eliminators are an industry standard and are supplied with the cooling tower by most vendors.

Low TDS Cooling Water:

Total dissolved solids are normally maintained at a reasonably low level in cooling towers to prevent deposition and fouling. Reduction in TDS to very low levels requires a significant increase in makeup water usage and treatment chemicals due to a significant increase in the blow-down required. Low TDS concentration is a technically feasible option for PM control from cooling towers.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Low TDS Cooling Water – 50 – 90%
2. High-Efficiency Drift Eliminators – 50 – 80%

Low TDS Cooling Water:

By reducing the TDS concentration to less than 1,000 ppm, particulate can typically be controlled to a high degree.

High-Efficiency Drift Eliminators:

Drift eliminators are often used to reduce the amount of drift in the exiting air flow. The four main types of drift eliminators are blade-type, herringbone, waveform, and cellular or honeycomb. Blade-type and herringbone drift eliminators are usually the least efficient; waveform drift eliminators are typically moderately efficient; cellular units are the most efficient.

Step 4 – Evaluate Remaining Control Technologies

Most of the emissions from cooling towers are a result of drift droplets, liquid water entrained in the air stream which are carried out of the tower. The amount of drift escaping the cooling tower depends on the type and model, the capacity, the velocity of the air, the temperature of the inlet and outlet flow, and the density of the air in the cooling tower. Drift loss can usually be obtained by requesting the drift loss from the manufacturer or vendor. Drift droplets can be reduced to less than 0.005% by effectively using a drift eliminator.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM_{10} and $PM_{2.5}$ control from cooling towers. Both remaining options are effective depending upon specific process conditions. Therefore, BACT is a combination of less than or equal to 1,000 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

BACT DETERMINATION FOR PRODUCT FINES BRIQUETTING

The screening and handling of DRI pellets results in undersize material, or fines. DRI fines will be recycled and formed into bricks for use in the blast furnace or off-site EAF furnaces. Fines will be mixed with a cement binder, and then pressed in molds to form bricks of uniform size and shape. After curing on racks, the bricks are transported for shipment off-site.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-117 - Briquetting Mill (EQT078)

Step 1 – Identify All Control Technologies

1. Fabric Filter (Baghouse)

2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression
6. Hooded Conveyors and Enclosed Transfer Stations

<u>Hooded Conveyors and Enclosed Transfer Stations:</u>

Hooded conveyors are an application of partial enclosures and wind screens that are specific to conveyor systems. The conveyor hoods work to help prevent wind from lifting dust particles from materials being transported on the conveyor. Similarly, enclosed transfer stations work to isolate material drop points between conveyors from the surrounding weather conditions. Enclosed transfer stations are typically designed with minimized material drop heights to reduce dust generated by materials being transferred.

Step 2 – Eliminate Technically Infeasible Options

<u>Fabric Filter (Baghouse):</u>

Fabric filters are the standard in the iron and steel industry for most $PM_{10}/PM_{2.5}$ control applications. Baghouses often are capable of 99.5% removal efficiencies, and baghouse removal efficiency is relatively level across the particle size range. However, DRI particles are known to react with oxygen in the atmosphere, reoxidizing in an exothermic reaction. This reoxidation process frequently causes fires when the DRI material is improperly handled, particularly when freshly discharged from the furnace before being passivated. The nature of the DRI particulate being captured makes the application of a fabric filter to this source a significant safety hazard, and thus a baghouse is technically infeasible.

<u>Electrostatic Precipitator:</u>

ESP's are capable of 99.5% or higher particulate removal, however several factors preclude their application to control $PM_{10}/PM_{2.5}$ from DRI dust emissions. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature. ESPs are especially sensitive to the electrical resistivity of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for the control of concentrated DRI dust sources.

Wet Suppression:

Wet suppression acts to prevent dust generation through the wetting of materials, and to settle dust more quickly by wetting the particles in air. However, directly wetting the fresh DRI product would unacceptably damage product quality by accelerating oxidation of the metal content. This may also cause excessive heat at points downstream of the control point, such as the product silos, potentially causing fires due to the oxidation reaction.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Wet Scrubber – 99%
2. Cyclone – 80%
3. Hood Conveyors and Enclosed Transfer Points – 95% (Conveyance only)

Potential control alternatives were reviewed for technical feasibility in controlling $PM_{10}/PM_{2.5}$ emissions from the briquetting process. Nucor has identified the highest remaining control option to be the application of wet scrubbing. $PM_{10}/PM_{2.5}$ emissions can be reduced by up to 99% by this technology.

Step 4 – Evaluate Remaining Control Technologies

Wet Scrubber:

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, and may be most appropriate for specific materials. DRI is one such material where wet scrubbing is particularly appropriate, because the water of the scrubber is able to prevent fires in the control device itself. Captured fines are oxidized safely in the scrubbing water, and removed from the water system at the water clarifier.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

Hooded Conveyors and Enclosed Transfer Stations:

Hooded conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Hooded conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates or grain.

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Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology is a high-energy wet scrubber achieving at least 99% control of PM_{10}. Additionally, hooded conveyors and enclosed transfer stations will be installed to limit emissions from material handling. Nucor will install a scrubber on the product storage silos for DRI dust control.

BACT DETERMINATION FOR PRODUCT LOADING

DRI pellets will be loaded for shipment to other Nucor facilities by barge. Due to the special handling requirement of the DRI product, the loading dock will be specialized for the loading of DRI product, and a single loading dock will service both DRI units.

BACT analyses for PM/PM_{10}/$PM_{2.5}$

Source ID – Description (EQT #)
DRI-118 - DRI Barge Loading Dock (EQT079)

Step 1 – Identify Potential Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression
6. Hooded Conveyors and Enclosed Transfer Stations

Step 2 – Eliminate Technically Infeasible Options

Fabric Filter (Baghouse):

Fabric filters are the standard in the iron and steel industry for most PM_{10}/$PM_{2.5}$ control applications. Baghouses often are capable of 99.5% removal efficiencies, and baghouse removal efficiency is relatively level across the particle size range. However, DRI particles are known to react with oxygen in the atmosphere, reoxidizing in an exothermic reaction. This reoxidation process frequently causes fires when the DRI material is improperly handled. The nature of the DRI particulate being captured makes the application of a fabric filter to this source a significant safety hazard, and thus a baghouse is technically infeasible.

Electrostatic Precipitator:

ESP's are capable of 99.5% or higher particulate removal, however several factors preclude their application to control $PM_{10}/PM_{2.5}$ from DRI dust emissions. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature. ESPs are especially sensitive to the electrical resistivity of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for the control of concentrated DRI dust sources.

Wet Suppression:

Wet suppression acts to prevent dust generation through the wetting of materials, and to settle dust more quickly by wetting the particles in air. However, directly wetting the fresh DRI product would unacceptably damage product quality by accelerating oxidation of the metal content. This may also cause excessive heat at points downstream of the control point, such as the product barges, potentially causing fires due to the oxidation reaction.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Wet Scrubber – 99%
2. Cyclone – 80%
3. Hood Conveyors and Enclosed Transfer Points – 95% (Conveyance only)

Potential control alternatives were reviewed for technical feasibility in controlling $PM_{10}/PM_{2.5}$ emissions from product loading. Nucor has identified the highest remaining control option to be the application of wet scrubbing. $PM_{10}/PM_{2.5}$ emissions can be reduced by up to 99% by this technology.

Step 4 – Evaluate Remaining Control Technologies

Wet Scrubber:

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, and may be most appropriate for specific materials. DRI is one such material where wet scrubbing is particularly appropriate, because the water of the scrubber is able to prevent fires in the control device itself. Captured fines are oxidized safely in the scrubbing water, and removed from the water system at the water clarifier.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

Hooded Conveyors and Enclosed Transfer Stations:

Hooded conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Hooded conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates or grain.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology is a high-energy wet scrubber achieving at least 99% control of $PM_{10}/PM_{2.5}$. Additionally, hooded conveyors and enclosed transfer stations will be installed to limit emissions from material handling. Nucor will install a scrubber on the product storage silos for DRI dust control.

BACT DETERMINATION FOR THE PACKAGE BOILER

The package boilers provide steam to each DRI unit. The steam is primarily used to heat the reboiler in the acid gas absorption system, as well as for utility purposes. The boiler is fired by natural gas, and will emit particulate matter as the products of incomplete combustion. Larger carbon compounds due to incomplete combustion are typically filterable. Smaller organics that are not completely combusted can be gaseous at typical flue gas temperatures, and later condense after being emitted by the source. Control technologies that rely upon direct filtration or capture of solid particles may be ineffective at controlling condensable particulate matter. In the case of natural gas combustion, half or more of total particulate is generally assumed to be condensable.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-109 - DRI Unit #1 Package Boiler Flue Stack (EQT070)
DRI-209 - DRI Unit #2 Package Boiler Flue Stack (EQT087)

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Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices

Good Combustion Practices:

Good combustion practices are used to reduce emissions of $PM_{10}/PM_{2.5}$, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. Particulate emissions from the burning of fuels are usually due to the incomplete combustion of hydrocarbon fuel, but may also be due to inorganic particles present in the fuel as an impurity. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices, both the filterable and condensable fractions of particulate matter normally emitted may be greatly reduced.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices - 50%

A review of the potential control options, and combination of options, was conducted to identify the most effective strategy for controlling $PM_{10}/PM_{2.5}$ emissions from the combustion of natural gas. Nucor has identified good combustion practices as the most effective and technically feasible control option.

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Good combustion practices can be effective at reducing $PM_{10}/PM_{2.5}$ emissions generated from the incomplete combustion of hydrocarbon fuels, because the technique limits both the filterable and condensable fractions of particulate emissions. Because of this property unique to the control technology set, and the fact that the majority of particulates generated by natural gas combustion are condensable, good combustion practices ranks the highest of the identified control technologies.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling $PM_{10}/PM_{2.5}$ from the package boiler is good combustion practices. Nucor will maintain good combustion practices at the package boiler to control the generation of $PM_{10}/PM_{2.5}$ emissions due to incomplete combustion of natural gas.

BACT DETERMINATION FOR NO_X EMISSIONS FROM PACKAGE BOILER

<u>BACT analyses for NO_X</u>

Source ID – Description (EQT #)
DRI-109 - DRI Unit #1 Package Boiler Flue Stack (EQT070)
DRI-209 - DRI Unit #2 Package Boiler Flue Stack (EQT087)

Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EMx ($SCONO_X$)
5. Low Excess Air (LEA) combustion
6. Low NOX Burners (LNB)

<u>Selective Catalytic Reduction (SCR):</u>

SCR is the most advanced of the potential flue-gas control technologies for reducing NOX emissions, and is the technology upon which the great majority of flue gas treatment units are based. SCR units use ammonia (NH_3) to selectively reduce NO_X to nitrogen and water. The ammonia, usually diluted with air or steam, is injected through a grid system into the flue gas stream, upstream of a catalyst bed. Operating temperatures between 500 °F and 800 °F are required of the gas stream at the catalyst bed, in order to carry out the catalytic reduction process. On the catalyst surface, the ammonia reacts with NO_X to form molecular nitrogen and water. Depending on system design, NO_X removal rates of 80 to 90 percent are achievable.

<u>Selective Non-Catalytic Reduction (SNCR):</u>

SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler or process heater. A temperature of between 1,600 °F (870 °C) and 2,100 °F (1,150 °C) is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NO_X in the gas to produce nitrogen and water. Multiple injection locations may be required within several different zones of the boiler to respond to variations in the boiler operating conditions.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 – 0.7% O2) and temperature (800 – 1,200 °F), and works best with certain windows of inlet concentration for NO_X (2,000 – 4,000 ppmv), CO (3,000 – 6,000 ppmv) and VOC (1,000 – 2,000 ppmv). These operating windows are necessary because the catalyst was developed to react the NO_X, CO and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band, and the presence of a small amount of oxygen. However, at optimal conditions it has the potential to reduce emissions of NO_X, CO and VOC simultaneously. It has seen use controlling emissions from internal combustion engines and nitric acid plants.

EMx (SCONOX):

EMx is primarily a NO_X control technology which works by oxidizing NO to NO_2, and trapping the NO_2 molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst, to CO_2. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and diatomic nitrogen. EMx operates best when treating gases that have a steady temperature, in the range of 300 – 700 °F.

EMx technology has been utilized through LAER as a multi-pollutant control technology applied to natural gas combustion turbines. The most recent literature available from the vendor indicates that EMx has seen seven applications to date, and all such applications have been to natural gas-fired turbine electric generators. The seven turbines applications represent approximately 112 MW of electrical power generation. EMx has never been determined as LAER for a reformer firing spent reducing gas, or other such large combustion chambers.

Low NO_X Burners (LNB):

LNBs have been used since the early 1970s for thermal NO_X control. These specially designed burners employ a variety of principles including LEA, off-stoichiometric (or staged) combustion (OSC), and flue gas recirculation (FGR). The objective in the application of LNBs is to minimize NO_X formation while maintaining acceptable combustion of carbon and hydrogen in the fuel.

The differences between a low NO_X burner and a burner featuring LEA or FGR, for example, are not always clear. In general, LNBs implement LEA, OSC, FGR, or a combination of these techniques. In a stricter sense, LNBs have been defined as burners that control NO_X formation by carrying out the combustion in stages (OSC) and, further, by controlling the staging at and within the burner rather than in the firebox. Consistent with this definition, there are two distinct types of designs for LNBs: staged air burners and staged fuel burners. Staged air burners are designed to reduce flame turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. The reduced availability of oxygen in the initial combustion zone inhibits fuel NO_X conversion. Radiation of heat from the primary combustion zone results in reduced temperature as the final unburned fuel gases mix with excess air to complete the combustion process. The longer, less intense flames resulting from the staged stoichiometry lower peak flame temperatures and reduce thermal NO_X formation.

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing NO_X emissions from the package boiler.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the control of condensable particulate matter addressed in sections 3.7.1 and 3.7.2. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. This technique has the effect of increasing particulate matter generated by combustion. This trade-off may be acceptable in certain applications, and typically this control method has been applied to rich burning internal combustion engines, not external combustion such as the package boiler. Due to the conflict with controls for other pollutants, this technology has been deemed to be technically infeasible.

EMx ($SCONO_X$):

Although the manufacturer claims that EMx technology is also applicable to internal combustion engines and industrial boilers, this claim has not been demonstrated on either type of combustion unit. The package boiler would represent a new application of EMx technology to a non-turbine combustion unit flue gas stream. Due to the lack of demonstrated applications for EMx to the reformer or other very large combustion chamber units, Nucor believes that this technology does have the practical potential for application to the package boiler that would make it an available technology under EPA's October 1990 *New Source Review Workshop Manual* guidance document.

Step 3 – Rank Remaining Technically Feasible Control Options

The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for top gas combustion efficiency. Top gas is known to have a lower heating value than natural gas.

1. Selective Catalytic Reduction (SCR) – 90%
2. Selective Non-Catalytic Reduction (SNCR) – 50%
3. Low NOX Burners (LNB) – 50%

Step 4 – Evaluate Remaining Control Technologies

Selective Catalytic Reduction:

SCR is the most effective NO_X control application for most combustion processes, and is capable of achieving a high rate of NO_X control where NO_X emissions are present in high enough concentrations. SCR is technically feasible for the control of DRI top gas combustion because the heating value of the top gas fuel is boosted by the addition of natural gas.

Selective Non-Catalytic Reduction (SNCR):

SNCR can provide a moderate level of control to NO_X emissions from natural gas combustion. It is most frequently applied to very large combustion units, where a wide and distinct zone exists at the proper temperature for the SNCR reaction.

Low NOX Burners (LNB):

Low NO_X burners are an effective means of reducing NO_X by staging combustion of the fuel, and recirculating flue gas locally at the burner in order to achieve low excess air conditions. Low NO_X burners are a common and technically feasible control device for natural gas combustion, and may be used in conjunction with an active control device.

Step 5 – Selection of BACT

All of the remaining available control technologies are technically feasible when used separately or in combination. Low-NO_X burners may be used in conjunction with an active control device such as SCR, without impairing the operation of the boiler. SCR may be applied to the resulting flue gas stream. Therefore, BACT for the package boiler is selected to be low NO_X burners, combined with selective catalytic reduction.

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent St. James Parish, Louisiana
PSD-LA-751
November 8, 2010

BACT DETERMINATION FOR SO_2 EMISSIONS FROM THE PACKAGE BOILER

Control technologies applied to SO_2 emissions from pure natural gas combustion were researched in the RACT/BACT/LAER Clearinghouse and issued air permits. It should be noted that the use of natural gas is often cited as a possible alternative for fuel switching in the analysis of BACT for SO_2 emissions from other fuels.

BACT analyses for SO_2

Source ID – Description (EQT #)
DRI-109 - DRI Unit #1 Package Boiler Flue Stack (EQT070)
DRI-209 - DRI Unit #2 Package Boiler Flue Stack (EQT087)

Step 1 – Identify Potential Control Technologies

1. Low Sulfur Fuel

Low Sulfur Fuel:

Emissions of SO_2 are usually attributable to the sulfur contained within the fuel being combusted. Therefore the use of a low sulfur fuel can drastically reduce emissions of SO_2 when compared to other potential fuels. Sweet natural gas is often cited as an alternative to other fuels due to the very low sulfur content of this fuel after gas treatment.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Low Sulfur Fuel

Step 4 – Evaluate Remaining Control Technologies

Low Sulfur Fuel:

Sweet natural gas is considered to be one of the cleanest fossil fuels available from the perspective of SO_2 emissions.

Step 5 – Selection of BACT

BACT is selected to be the combustion of sweet natural gas. Nucor will purchase pipeline-quality natural gas for use in the package boiler.

BACT DETERMINATION FOR CO & VOC EMISSIONS FROM THE PACKAGE BOILER

BACT analyses for CO and VOC

Source ID – Description (EQT #)
DRI-109 - DRI Unit #1 Package Boiler Flue Stack (EQT070)
DRI-209 - DRI Unit #2 Package Boiler Flue Stack (EQT087)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices

Good Combustion Practices:

Good combustion practices are used to reduce emissions of carbon monoxide, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. CO and VOC emissions from the burning of fuels are usually due to the incomplete combustion of hydrocarbon fuel. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices CO and VOC emissions may be greatly reduced.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices - 50%

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Good combustion practices can be relatively effective at reducing CO and VOC emissions generated from the incomplete combustion of hydrocarbon fuels, because the technique maximizes combustion within the unit. Good combustion practices will aim to completely combust the hydrocarbons in the fuel.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling CO and VOC emissions from the package boiler is good combustion practices. Nucor will maintain good combustion practices at the package boiler to control the generation of CO and VOC emissions due to incomplete combustion.

BACT DETERMINATION FOR CO_{2e} EMISSIONS FROM THE PACKAGE BOILER

<u>BACT analyses for CO_{2e}</u>

Source ID – Description (EQT #)
DRI-109 - DRI Unit #1 Package Boiler Flue Stack (EQT070)
DRI-209 - DRI Unit #2 Package Boiler Flue Stack (EQT087)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices

Good Combustion Practices:

Minimizing the use of natural gas fuel is naturally the primary method of reducing GHG emissions from combustion. Energy integration has the most potential for reducing fuel consumption, by reducing energy waste as much as possible. Good combustion practices are used to reduce emissions of carbon dioxide, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Competing environmental interests take shape when simply maximizing combustion efficiency. Increasing combustion efficiency may improve GHG emissions, yet increase emissions of NO_X due to higher flame temperatures. The preferred method of controlling NO_X emissions is to reduce flame temperatures using flue gas recirculation or lowered temperature in the preheat air. This is often accomplished through the use of specially design burners called Low-NO_X Burners (LNB). The use of LNB or other combustion controls has the net impact of decreasing combustion efficiency in favor of lower NO_X emissions. This necessarily results in higher GHG emissions than standard burners. Due to this cross-pollutant relationship, the LNB design for the package shall remain, maintaining lower NO_X levels.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling CO_{2e} emissions from the package boiler is good combustion practices. BACT shall be good combustion practices, which will be adhered to maintain low levels of fuel consumption by the LNB burners.

BACT DETERMINATION FOR THE REMAINING SOURCES

The Direct Reduction Iron process consists of two main components, a Reformer and the DRI reactor.

The Reformer is a tubular style natural gas reformer. Natural gas passes through special catalyst tubes where the natural gas dissociates into a reducing gas rich in carbon monoxide and hydrogen, which are the primary chemicals used to remove the oxygen from the iron ore. This reaction takes place at elevated temperatures produced in the region surrounding the catalyst filled tubes by combusting natural gas. The reducing gas consists of about 95% combined hydrogen plus carbon monoxide. It is heated to a temperature range of 1400° to 1700°F and is fed in from the bottom of the DRI Reactor. The gas flows countercurrent to the descending iron ore pellets. At the top of the reactor, the partially spent reducing gas (approximately 70% hydrogen plus carbon monoxide) exits and is recompressed, enriched with natural gas, preheated to 750°F, and transported back to the gas reformer. The reformer reforms the mixture back to 95% hydrogen plus carbon monoxide, which is then ready for re-use by the direct reduction furnace.

As a cost savings measure, some of the reducing gas that has already passed over the iron ore in the DRI reactor (the spent reducing gas is also known as top gas) is mixed with the natural gas that is being combusted in the reformer and is also therefore combusted.

A portion of the combusted reformer flue gas stream (The combustion end products of the natural gas, air and spent reducing gas) is used as seal gas to retain the reducing gas in the shaft furnace. A small amount of seal gas maintains both an upper seal underneath the charge hopper where the iron ore enters the DRI reactor, and a lower seal above the product discharge point. Seal gas is also used as a padding to protect finished product from the atmosphere in the product silos.

When evaluating BACT controls, there are four locations where pollution control can occur. Pre combustion fuel cleaning, control during combustion, add on post combustion controls prior to the seal gas stream split and control of pollutants on final use venting. Since there are two separate fuel gas supplies, the BACT analysis also evaluated as appropriate these controls as applicable to the fuel gases. For each of the separate pollutants being evaluated, different choices were made as to the location chosen to implement BACT controls.

The remaining sources all use the combusted reformer flue gas stream.

BACT DETERMINATION FOR $PM_{10}/PM_{2.5}$ EMISSIONS FROM THE REFORMER MAIN FLUE GAS STACK

Spent reducing furnace gas is combusted as fuel in the reformer in order to recover the remaining chemical energy in the gas. Top gas has a low fuel value, about one-fourth that of natural gas, so the fuel is mixed with natural gas to maintain stable combustion by increasing the BTU content of the top gas, and to provide enough energy to run the reforming process. A portion of the top gas stream is used as a fuel in the reformer. Use of top gas as a fuel in the reformer significantly increases the overall energy efficiency of the DRI process.

PM_{10} emissions from natural gas combustion are usually from large-molecular-weight hydrocarbons that are not fully combusted. Condensable organic PM_{10} can be best controlled through good combustion practices.

<u>BACT analyses for $PM/PM_{10}/PM_{2.5}$</u>

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent St. James Parish, Louisiana
PSD-LA-751
November 8, 2010

Source ID – Description (EQT #)
DRI-108 - DRI Unit #1 Reformer Main Flue Stack (EQT069)
DRI-208 - DRI Unit #2 Reformer Main Flue Stack (EQT086)

The top gas contains incombustible particulate matter in the stream as it leaves the shaft furnace. This particulate would pass through the combustion zone and be emitted in the reformer flue gas if left untreated. Therefore, the control of particulate from the seal gas system addresses the cleaning of the top gas prior to its combustion as a fuel.

Step 1 – Identify Potential Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Good Combustion Practices

Step 2 – Eliminate Technically Infeasible Options

Fabric Filter (Baghouse):

Fabric filters are the standard in the iron and steel industry for most PM_{10} control applications. Baghouses often are capable of 99.5% removal efficiencies, and baghouse removal efficiency is relatively level across the particle size range. However, DRI particles are known to react with oxygen in the atmosphere, reoxidizing in an exothermic reaction. This reoxidation process frequently causes fires when the DRI material is improperly handled, particularly when freshly discharged from the furnace before being passivated. The nature of the DRI particulate being captured makes the application of a fabric filter to this source a significant safety hazard, and thus a baghouse is technically infeasible.

Electrostatic Precipitator:

ESP's are capable of 99.5% or higher particulate removal, however several factors preclude their application to control $PM_{10}/PM_{2.5}$ from DRI dust emissions. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature. ESPs are especially sensitive to the electrical resistivity of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for the control of concentrated DRI dust sources.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Wet Scrubber - 99%
2. Cyclone - 80%
3. Good Combustion Practices - < 50%

A review of the potential control options, and combination of options, was conducted to identify the most effective strategy for controlling $PM_{10}/PM_{2.5}$ emissions from the combustion of top gas. Nucor has identified a wet scrubber as the most effective and technically feasible control option.

Step 4 – Evaluate Remaining Control Technologies

Wet Scrubber:

High-energy wet scrubbers can achieve a high degree of particle separation from gas streams with a variety of physical characteristics. Scrubber systems are able to accommodate large volumes of gas with high moisture contents and high particulate loading. However, wet scrubbers may not be appropriate for treating high temperature gas streams, and they also require water treatment and sludge disposal that are not required for other PM_{10} control options. Scrubbers may be particularly suited to specific materials, such as DRI particles, where hazards exist with other control options.

Cyclone:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts such as PM_{10} are not removed as effectively due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream. Cyclones are frequently used in combination with another control technology to provide a higher overall control efficiency.

Good Combustion Practices:

Good combustion practices can be somewhat effective at reducing $PM_{10}/PM_{2.5}$ emissions generated from the incomplete combustion of hydrocarbon fuels. However, good combustion practices have little effect in controlling emissions of particulate that are already present in a fuel gas stream. Due to the nature of top gas, which contains inert particulate matter as it leaves the shaft furnace, and is not a hydrocarbon fuel that has the potential to generate products of incomplete combustion, good combustion practices at the reformer are ranked as the least effective remaining control option.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling $PM_{10}/PM_{2.5}$ from the reformer is a high-energy wet scrubber. A wet scrubber can accommodate the large volume of gas that is generated by the DRI process, and is insensitive to variations in dust loading. Additionally, the safety aspects of using a wet system provide the most viable scenario for $PM_{10}/PM_{2.5}$ emissions control from the DRI process, by cleaning the top gas fuel stream prior to combustion. Nucor will also maintain good combustion practices at the reformer for particulate control of the natural gas combustion, but these actions are not likely to significantly contribute to the control of PM_{10} emissions due to the inorganic nature of topgas.

BACT DETERMINATION FOR NO_X EMISSIONS FROM THE REFORMER MAIN FLUE GAS STACK

BACT analyses for NO_X

Source ID – Description (EQT #)
DRI-108 - DRI Unit #1 Reformer Main Flue Stack (EQT069)
DRI-208 - DRI Unit #2 Reformer Main Flue Stack (EQT086)

Step 1 – Identify Potential Control Technologies

A search of USEPA's RBLC database revealed no entries for the control of NO_x from DRI Reformer combustion. A review of available literature did not discover any applications of control technology to the combustion of top gas for the reduction of NO_x emissions. The following list of control technologies represent technologies that have been used for the control of NO_x from other combustion sources and in other industries.

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM_X ($SCONO_X$)
5. Low Excess Air (LEA) combustion
6. Low NO_X Burners (LNB)
7. Low NO_X Fuel Combustion (LNC)

Low NO_X Burners (LNB):

LNBs have been used since the early 1970s for thermal NO_X control. These specially designed burners employ a variety of principles including LEA, off-stoichiometric (or staged) combustion (OSC), and flue gas recirculation (FGR). The objective in the application of LNBs is to minimize NO_X formation while maintaining acceptable combustion of carbon and hydrogen in the fuel.

The differences between a low NO_X burner and a burner featuring LEA or FGR, for example, are not always clear. In general, LNBs implement LEA, OSC, FGR, or a combination of these techniques. In a stricter sense, LNBs have been defined as burners that control NO_X formation by carrying out the combustion in stages (OSC) and, further, by controlling the staging at and within the burner rather than in the firebox. Consistent with this definition, there are two distinct types of designs for LNBs: staged air burners and staged fuel burners. Staged air burners are designed to reduce flame turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. The reduced availability of oxygen in the initial combustion zone inhibits fuel NO_X conversion. Radiation of heat from the primary combustion zone results in reduced temperature as the final unburned fuel gases mix with excess air to complete the combustion process. The longer, less intense flames resulting from the staged stoichiometry lower peak flame temperatures and reduce thermal NO_X formation.

Low-NO_X Fuel Combustion (LNC):

A low-NO_X fuel is one which results in a lower generation rate of NO_X over traditional fossil fuels, on an equal energy basis. DRI top gas is a low-NO_X fuel, generating less than half of the NO_X per unit of energy as natural gas. This property is due to the low-BTU value of top gas, which burns at a cooler temperature, preventing the formation of a majority of the NO_X seen with natural gas combustion.

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing NO_X emissions from the reformer.

Selective Non-Catalytic Reduction (SNCR):

SNCR can only be effectively when used in applications where the temperature of the gas stream is extraordinarily high, between 1,600 – 2,100 °F. Due to the low heating value of the top gas combusted in the reformer, the temperature of the flue gas never reaches temperatures in the effective range. Thus, SNCR is not a feasible control technology for the control of NO_X from the reformer.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of reformer top gas. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the top gas does not allow for combustion at low levels of combustion air. Additionally, levels of NO_X and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the reformer will not reach the level required, to promote the catalytic reaction. Thus NSCR is not a feasible control technology for the control of NO_X from reformer.

EM_x ($SCONO_x$):

Although the manufacturer claims that EM_X technology is also applicable to internal combustion engines and industrial boilers, this claim has not been demonstrated on either type of combustion unit, or on combustion devices such as the DRI process reformer. The reformer would represent a new application of EM_X technology to a non-turbine combustion unit flue gas stream, and on a scale not yet demonstrated by EM_X even on gas turbines. Due to the lack of demonstrated applications for EM_X to the reformer or other very large combustion chamber units, Nucor believes that this technology does have the practical potential for application to the reformer that would make it an available technology under EPA's October 1990 *New Source Review Workshop Manual* guidance document.

Step 3 – Rank Remaining Technically Feasible Control Options
The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for top gas combustion efficiency. Top gas is known to have a lower heating value than natural gas.

1. Selective Catalytic Reduction (SCR) – 90%
2. Low NO_X Burners (LNB) – 50%
3. Low NO_X Fuel Combustion (LNC) – 50%

Step 4 – Evaluate Remaining Control Technologies

Selective Catalytic Reduction:

SCR is the most effective NO_X control application for most processes, and is capable of achieving a high rate of NO_X control where NO_X emissions are present in high enough concentrations. SCR is technically feasible for the control of DRI top gas combustion because the heating value of the top gas fuel is boosted by the addition of natural gas.

<u>Low NO_X Burners (LNB):</u>

Low NO_X burners are an effective means of reducing NO_X by staging combustion of the fuel, and recirculating flue gas locally at the burner in order to achieve low excess air conditions. Low NO_X burners are technically feasible for the control of DRI top gas combustion because the heating value of the top gas fuel is boosted by the addition of natural gas.

<u>Low NO_X Fuel Combustion (LNC):</u>

The low heating value of DRI top gas makes it an inherently lower NO_X-generating fuel, due to lower flame temperature when combusted. However, this property of top gas is mitigated by the addition of natural gas to the fuel, boosting the heating value to approximately 35% of natural gas.

Step 5 – Selection of BACT

All of the remaining available control technologies are technically feasible when used separately or in combination. The low NO_X combustion qualities of top gas fuel are inherent in the DRI reforming process. Additionally, low-NO_X burners may be used with the boosted heating value of top gas mixed with natural gas, without unduly penalizing combustion efficiency. Finally, SCR may be applied to the resulting flue gas stream from combustion in the reformer. Therefore, BACT is selected to be low NO_X fuel combustion, combined with low NO_X burners and selective catalytic reduction.

BACT DETERMINATION FOR CO AND VOC EMISSIONS FROM THE REFORMER MAIN FLUE GAS STACK

<u>BACT analyses for CO and VOC</u>

Source ID – Description (EQT #)
DRI-108 - DRI Unit #1 Reformer Main Flue Stack (EQT069)
DRI-208 - DRI Unit #2 Reformer Main Flue Stack (EQT086)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices

<u>Good Combustion Practices:</u>

Good combustion practices are used to reduce emissions of carbon monoxide, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. CO and VOC emissions from the burning of fuels are usually due to the incomplete combustion of hydrocarbon fuel. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices CO and VOC emissions may be greatly reduced.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices - 50%

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Good combustion practices can be relatively effective at reducing CO and VOC emissions generated from the incomplete combustion of hydrocarbon or CO fuels, because the technique maximizes combustion within the unit. The combustible components of the top gas fuel used in the reformer are primarily of carbon monoxide and hydrogen, mixed with a quantity of natural gas to provide stable combustion characteristics and the necessary heat input to the unit. Good combustion practices will aim to completely combust the carbon monoxide in the fuel, as well as the natural gas hydrocarbons.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling CO emissions from the reformer is good combustion practices. Nucor will maintain good combustion practices at the reformer to control the generation of CO and VOC emissions due to incomplete combustion.

BACT DETERMINATION FOR CO_{2e} EMISSIONS FROM THE REFORMER MAIN FLUE GAS STACK

Current DRI process designs release carbon dioxide from the process gas loop by off-taking a stream of spent reducing gas (prior to recycle back to the reformer) and using this stream as fuel in the reformer. Carbon dioxide is born in the fuel gas and simply passes through the combustion process as an inert. While this increases the energy efficiency of the reformer by providing more gases to surround the reformer tubes for heat transfer, the carbon dioxide is still released to the atmosphere.

In evaluating the use of natural gas as a raw material, an inefficient DRI process will consume large volumes of natural gas for each tonne of DRI produced, while an efficient process will operate closer to theoretical limits of DRI/natural gas ratios. These theoretical limits are based upon the stoichiometry of the reduction reaction. One means of reducing natural gas consumption closer to stoichiometric levels is to remove the oxygen that is being freed from the iron oxide ore from the recycle loop of the reducing gas. This oxygen, in the form of carbon dioxide or water vapor, inhibits the reaction of carbon monoxide or hydrogen with the oxygen of the ore when either or both are present at high levels. While some carbon dioxide and water is necessary in the reactions of the reformer, the removal of excess carbon dioxide and water from the system will improve overall efficiency.

BACT analyses for CO_{2e}

Source ID – Description (EQT #)
DRI-108 - DRI Unit #1 Reformer Main Flue Stack (EQT069)
DRI-208 - DRI Unit #2 Reformer Main Flue Stack (EQT086)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices
2. Acid gas separation system
3. Energy integration

Good Combustion Practices:

Minimizing the use of natural gas fuel is naturally the primary method of reducing GHG emissions from combustion. Energy integration has the most potential for reducing fuel consumption, by reducing energy waste as much as possible. Good combustion practices are used to reduce emissions of carbon dioxide, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone.

Acid gas separation system

An acid gas removal system using an amine absorber system has the ability to separate carbon dioxide from the spent reducing gas prior to combustion in the reformer. After treatment for sulfur compounds, the resulting gas is nearly pure carbon dioxide, which may require little additional processing effort to produce pipeline-quality, commercial grade CO_2. Removing CO_2 from the spent reducing gas fuel has the added benefit of increasing combustion efficiency in the reformer.

Energy integration

The DRI process design includes the use of spent reducing gas from the process, known as top gas, as fuel for the process. This top gas fuel is mixed with the fuel natural gas, replacing a portion of the needed heat input to the process. This design integrates the energy cycle of the process in order to capture as much residual chemical energy from the reaction furnace as possible.

In addition, the DRI process inherently removes water vapor from the spent reducing gas being recycled to the reformer in a quench step. As the gas is cooled, its capacity to hold water is reduced, and the water is captured in the process water system. Removing water from the spent reducing gas fuel has the added benefit of increasing combustion efficiency in the reformer.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices
2. Acid gas separation system
3. Energy integration

Step 4 – Evaluate Remaining Control Technologies

Competing environmental interests take shape when simply maximizing combustion efficiency. Increasing combustion efficiency may improve GHG emissions, yet increase emissions of NO_X due to higher flame temperatures. The preferred method of controlling NO_X emissions is to reduce flame temperatures using flue gas recirculation or lowered temperature in the preheat air. This is often accomplished through the use of specially design burners called Low-NO_X Burners

(LNB). The use of LNB or other combustion controls has the net impact of decreasing combustion efficiency in favor of lower NO_X emissions. This necessarily results in higher GHG emissions than standard burners. Due to this cross-pollutant relationship, the LNB design for the package shall remain, maintaining lower NO_X levels.

The most relevant parameter which can be measured is natural gas consumption. Reducing the quantity of natural gas consumed by the process is the most effective means of reducing GHG generation. Historical rates of GHG emissions for the DRI process, measured using the unit metric of natural gas consumption per tonne of product has decreased over time as market forces have driven process efficiency. Early designs of the DRI process could be expected to meet an efficiency of 15 decatherms of natural gas per tonne of DRI produced. This efficiency metric has gradually fallen over several years, until the current-day state of the art is expected to require no more than 13 decatherms of natural gas per tonne of DRI.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling CO_{2e} emissions from the package boiler is good combustion practices, the Acid gas separation system, and Energy integration. BACT shall be good combustion practices, which will be adhered to maintain low levels of fuel consumption by the LNB burners.

Due to production rate and product quality variability in any production process, production rates should be inclusive of all production at the facility, both of regular and off-spec materials. Additionally, natural gas is consumed in the DRI process as both a raw material (for the formation of reducing gas) and as a fuel (for heating to reaction temperatures). All sources of natural gas consumption at the Reformer should be included in the analysis. BACT is no more than 13 decatherms of natural gas per tonne of DRI (11.79 MM Btu/ton of DRI). Compliance with the BACT limit shall be determined on the basis of total natural gas consumption, divided by total production (including regular and off-spec DRI product) of the facility on a 12-month rolling average.

BACT DETERMINATION FOR SO_2 EMISSIONS FROM THE REFORMER MAIN FLUE GAS STACK

BACT analyses for SO_2

Source ID – Description (EQT #)
DRI-108 - DRI Unit #1 Reformer Main Flue Stack (EQT069)
DRI-208 - DRI Unit #2 Reformer Main Flue Stack (EQT086)

Emissions of SO_2 are usually attributable to the sulfur contained within the fuel being combusted. Therefore the use of a low sulfur fuel can drastically reduce emissions of SO_2 when compared to other potential fuels. Sweet natural gas is often cited as an alternative to other fuels due to the very low sulfur content of this fuel
The reformer also burns top gas from the shaft furnace, which contains a small portion of hydrogen sulfide originating from sulfur compounds in the iron ore, as well as any sulfur that was in the natural gas converted into reformer gas. Once combusted, this hydrogen sulfide converts directly to SO_2. Because sulfur is rarely introduced into a combustion reaction other than as a component of the fuel, Nucor evaluated both fuel treatment for the removal of hydrogen sulfide and other sulfur compounds, as well as flue gas desulfurization (FGD) for the removal of SO_2 from the products of combustion in the flue gas.

Step 1 – Identify Potential Control Technologies

1. Acid Gas Absorption
2. Wet Scrubbing
3. Spray Dryer Absorber
4. Dry Sorbent Injection

Acid Gas Absorption:

Acid gas absorption removes reduced sulfur compounds from a gas stream by selectively absorbing acid gases in an amine-based medium. The rich amine solvent is then regenerated by the application of heat in a separate column, liberating the dissolved acid gases for a separate use or treatment.

Wet Lime Scrubbing:

Wet scrubbers are designed to maximize contact between the exhaust gas and an absorbing liquid. The exhaust gas is scrubbed with a slurry composed of 5 - 15% CaO (lime) or $CaCO_3$ (limestone) in suspension. The SO_2 in the gas stream reacts to form $CaSO_3$ and $CaSO_4$. The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or $CaCO_3$ has been added.

The types of scrubbers that can adequately disperse the scrubbing liquid include packed towers. plate or tray towers, spray chambers, and venturi scrubbers. In addition to $CaSO_3$ or $CaSO_4$, numerous other absorbents are available including sodium bicarbonate solutions and NH_3 based solutions.

Spray Dryer Absorber:

An alternative to wet scrubbing is a process known as semi-dry scrubbing using a spray dryer. As in wet scrubbing, the gas phase SO_2 is removed by contact with the suitable reactant suspended in water. Typically, this may be an aqueous solution of Na_3CO_3 or $Ca(OH)_2$. In spray dryer systems, the solution is pumped to atomizers, which create a spray of very fine droplets. The droplets mix with the incoming SO_2 in the flue gas in a very large chamber, and subsequent absorption leads to the formation of sulfites and sulfates in the droplets. Almost simultaneously, the sensible heat of exhaust gas that enters the chamber evaporates the water in the droplets, leaving a fine dry powder before the gas leaves the spray dryer. Typically, baghouses employing Teflon-coated fiberglass bags (to minimize bag corrosion) are used to collect the precipitated particulates, which contain both reacted and unreacted products. In some systems, this mixture of particulates is recycled to improve efficiency.

Dry Sorbent Injection:

Dry sorbent injection involves the addition of an alkaline material (usually hydrated lime or soda ash) into the gas stream to react with the acid gases. This control option typically involves the injection of dry powders into either the furnace or post furnace region of boilers. Higher collection efficiencies can be achieved by increasing the flue gas humidity. The technology is generally only effective at controlling gas streams with a high concentration of acid gases.

Step 2 – Eliminate Technically Infeasible Options

None of the identified technologies is technically infeasible when applied to the combustion of reduced sulfur compounds in the reformer. None of the technologies have been eliminated based on technical considerations.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Acid Gas Absorption - 95%
2. Wet Scrubbing – 90%
3. Spray Dryer Absorber – 90%
4. Dry Sorbent Injection – 80%

Step 4 – Evaluate Remaining Control Technologies

Acid Gas Absorption:

An amine absorber system is capable of removing 95% or more of the acid hydrogen sulfide gas with the top gas fuel. By treating the fuel prior to combustion within the reformer, SO_2

emissions are reduced by the same efficiency.

Wet Scrubbing:

Wet scrubbing is a common and effective flue gas desulfurization technique. However, as with all FGD technologies, it achieves higher control efficiencies when treating gas streams with high concentrations of sulfur dioxide, such as high-sulfur coal combustion. The reformer is not expected to have a high sulfur concentration since it burns a mixture of sweet natural gas and top gas. The primary source of sulfur is then the iron ore itself, which does not contain high quantities of sulfur.

Spray Dryer Absorber:

Semi-dry scrubbing is a common and effective flue gas desulfurization technique. However, as with all FGD technologies, it achieves higher control efficiencies when treating gas streams with high concentrations of sulfur dioxide, such as high-sulfur coal combustion. The reformer is not expected to have a high sulfur concentration since it burns a mixture of sweet natural gas and top gas. The primary source of sulfur is then the iron ore itself, which does not contain high quantities of sulfur.

Dry Sorbent Injection:

Dry sorbent injection is often used in very large existing unit applications where the retrofit of a scrubbing system is in practical. It has never achieved the same level of control as active flue gas desulfurization, and as with all FGD technologies it achieves higher control efficiencies when treating gas streams with high concentrations of sulfur dioxide, such as high-sulfur coal combustion. The reformer is not expected to have a high sulfur concentration since it burns a mixture of sweet natural gas and top gas. The primary source of sulfur is then the iron ore itself, which does not contain high quantities of sulfur.

Step 5 – Selection of BACT

BACT is selected to be the removal of hydrogen sulfide from the top gas fuel through acid gas scrubbing. This technology was identified as the most stringent control method of the available technologies, and has the added benefit of slightly reducing energy demand at the reformer. Nucor will install and acid gas scrubbing system for top gas prior to its use as fuel in the reformer. BACT for natural gas is to purchase natural gas containing no more than 2000 grains of Sulfur per MM scf.

BACT DETERMINATION FOR THE ACID GAS ABSORPTION VENT

Acid gases, primarily hydrogen sulfide and carbon dioxide, are removed from the top gas prior to its use as a fuel in the acid gas absorption unit. This unit is an amine-based absorption scrubber, which selectively dissolves acid gases from the top gas fuel. The amine solution is then regenerated by applying heat in a steam reboiler, which liberates the acid gases from solution. The resulting gas stream is treated for the removal of sulfur compounds prior to being vented.

BACT analyses for $PM/PM_{10}/PM_{2.5}$

Source ID – Description (EQT #)
DRI-111 - DRI Unit #1 Acid Gas Absorption Vent (EQT072)
DRI-211 - DRI Unit #1 Acid Gas Absorption Vent (EQT089)

Emissions of PM_{10} from the acid gas absorption vent are due to the absorption of $PM_{10}/PM_{2.5}$ in the amine unit treating the top gas fuel, which is partially released during the amine regeneration step. Due to the low quantity of emissions from the acid gas absorption vent, less than one ton per year from both DRI units combined, No technologies exist which meet the environmental, energy and economic considerations inherent in a BACT review. BACT for emissions of $PM_{10}/PM_{2.5}$ from the acid gas absorption vent is determined to be no control.

BACT analyses for SO_2

Source ID – Description (EQT #)
DRI-111 - DRI Unit #1 Acid Gas Absorption Vent (EQT072)
DRI-211 - DRI Unit #1 Acid Gas Absorption Vent (EQT089)

The acid gas absorber selectively removes acid gases such as hydrogen sulfide and carbon dioxide from the top gas fuel, prior to combustion at the reformer. The amine-based absorption medium is then regenerated by the application of heat, releasing the absorbed acid gases as a separate gas stream. The efficiency of the DRI process benefits from the removal of these gases, which are no longer heated during combustion. The energy saved from no longer heating inert gases in the top gas fuel is then available for the reforming reaction. An added benefit is the isolation of hydrogen sulfide, which can then be treated more effectively.

Nucor searched the RBLC database, recent permitting decisions and technical descriptions of operating DRI facilities abroad. The search produced no evidence that sulfur treatment has yet been applied to any operating DRI production units in the world. However, with the advancement of acid gas adsorption technology, Nucor investigated the potential for sulfur treatment being applied to the DRI process in conjunction with the amine absorber system.

Step 1 – Identify Potential Control Technologies

1. Claus Process
2. SulfaTreat Catalyst Bed
3. LO-CAT Redox Process

Claus Process:

The Claus process captures hydrogen sulfide and converts it to elemental sulfur. This process is widely used in the petroleum refining industry to produce a saleable sulfur product during the sulfur removal steps of oil refining. The Claus process requires a concentrated hydrogen sulfide stream, and is ineffective at treating gas streams with high concentrations of carbon dioxide.

SulfaTreat Catalyst Bed:

The SulfaTreat process utilizes a mixed metal oxide oxidation-reduction catalyst to partially oxidize hydrogen sulfide and capture sulfur on the catalyst substrate itself as iron pyrite. The SulfaTreat process is capable of treating very low concentrations of hydrogen sulfide, at a wide range of operating conditions. This sulfur scavenging catalyst bed must be replaced once saturated, an event which is expected to occur once every few years.

LO-CAT Redox Process:

LO-CAT is an iron-based liquid oxidation-reduction process which converts the hydrogen sulfide in a gas stream into elemental sulfur and water. LO-CAT uses a chelated iron catalyst, and is capable of high removal efficiencies at wide ranges of hydrogen sulfide concentration, operating flow rate and operating pressure. The process generates a sulfur cake byproduct, which may be sold or disposed.

Step 2 – Eliminate Technically Infeasible Options

Claus Process:

The Claus process requires a concentrated source of hydrogen sulfide in order to operate effectively. Additionally, high concentrations of carbon dioxide have been demonstrated to prevent operation of a Claus process unit. Claus units are well suited to the oil refining industry, because hydrogen sulfide is typically the predominant acid gas in refined petroleum products, and is selectively removed by amine absorbers at a high purity. However, the DRI top gas contains a large volume of carbon dioxide, which is also separated by the amine absorption system. The resulting acid gas stream has a low concentration of hydrogen sulfide and high concentration of carbon dioxide, a condition that the Claus process is not capable of accommodating. For this reason, the Claus process has been deemed technically infeasible.

Step 3 – Rank Remaining Technically Feasible Control Options

1. SulfaTreat Catalyst Bed – 99%
2. LO-CAT Redox Process – 99%

Step 4 – Evaluate Remaining Control Technologies

SulfaTreat Catalyst Bed:

The SulfaTreat catalyst has the ability to remove sulfur compounds within a wide range of concentrations in a gas stream. It is best applied to small concentrations of hydrogen sulfide, for which it can achieve high removal efficiencies and provide a long catalyst bed life, minimizing catalyst replacement events. The spent catalyst is non-toxic and disposed of as a non-hazardous solid waste.

LO-CAT Redox Process:

The LO-CAT process has the ability to remove sulfur compounds within a wide range of concentrations in a gas stream. The LO-CAT process typically requires a higher capital cost but lower operating cost relative to the SulfaTreat catalyst, and achieves an essentially equal level of control.

Step 5 – Selection of BACT

BACT is selected to be treatment of the acid gas stream through the use of a sulfur redox catalyst, such as the SulfaTreat catalyst bed or LO-CAT Redox process, for the removal of H_2S. Nucor will install a redox catalyst on each of the acid gas absorption vents at the DRI facility for the control of sulfur compound emissions.

BACT analyses for CO

Source ID – Description (EQT #)
DRI-111 - DRI Unit #1 Acid Gas Absorption Vent (EQT072)
DRI-211 - DRI Unit #1 Acid Gas Absorption Vent (EQT089)

Emissions of carbon monoxide from the acid gas absorption vent are due to the slight absorption of CO in the amine unit treating the top gas fuel. Due to the low quantity of emissions from the acid gas absorption vent, no technologies exist which meet the environmental, energy and economic considerations inherent in a BACT review. BACT for emissions of carbon monoxide from the acid gas absorption vent is determined to be no control.

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent St. James Parish, Louisiana
PSD-LA-751
November 8, 2010

BACT DETERMINATION FOR THE UPPER SEAL GAS VENT, DRI FURNACE DUST COLLECTION, AND DRI PRODUCT STORAGE SILO DUST COLLECTION SYSTEMS

Iron oxide pellets are fed continuously into the shaft furnace from the top, and pass down through the reaction area by gravity. Reducing gas from the Reformer is passed through the iron oxide as it progresses through the furnace, in a countercurrent fashion. The DRI product then continuously exits the bottom of the furnace onto a waiting conveyor. In order to prevent the reducing gas from escaping the furnace, a higher pressure gas called seal gas is applied at both the charging and discharging opening. The seal gas is allowed to escape the furnace while the reducing gas is retained. Due to the higher seal gas pressure, a portion is also entrained into the reactor and combined with the spent reducing gas travels back to the Reformer. As previously described, this seal gas is merely a small amount of cooled flue gas from the reformer combustion side, and primarily consists of atmospheric nitrogen, carbon dioxide and water vapor.

BACT analyses for CO, NO_X, $PM/PM_{10}/PM_{2.5}$ and SO_2

Source ID – Description (EQT #)
DRI-106 - DRI Unit No. 1 Upper Seal Gas Vent (RLP020)
DRI-206 - DRI Unit No. 2 Upper Seal Gas Vent (RLP021)
DRI-107 - DRI Unit No. 1 Furnace Dust Collection (EQT068)
DRI-207 - DRI Unit No. 2 Furnace Dust Collection (EQT085)
DRI-112 - DRI Unit No. 1 Product storage silo Dust Collection (EQT073)
DRI-212 - DRI Unit No. 2 Product storage silo Dust Collection (EQT090)

The seal gas is removed before the flue gas is treated for NO_X control. The SCR controlling NO_X from the reformer contributes ammonia to the reformer flue gas. Ammonia would react with the lime coating on the iron oxide pellets to form ammonium bicarbonate and ammonium carbamate, which are a sticky white salt. These compounds would tend to promote fusion of the iron ore pellets, which can cause a significant process upset as the clumped product cannot be removed from the shaft furnace. BACT for VOC and CO were already determined as good combustion practices for the Reformer Flue gas and so no additional control is feasible for the use of a small portion of this flue gas as seal gas. Sulfur dioxide and particulate matter BACT was determined to treat the spent reducing gas being sent to the Reformer as combustion fuel and so no additional control is feasible for the seal gas. Emissions of these four pollutants are expected to be less than five tons per year combined. It should be noted that all of the spent reducing gas has particulate matter emission controlled, while only that portion that is sent for combustion in the reformer is treated for sulfur dioxide emissions.

Of the systems using the seal gas, the DRI Product exits the cooling zone of the shaft furnace and falls onto a waiting conveyor for transport to the product silos. This discharge point has a high potential for dust generation, since any fines generated during the action of the pellets passing through the reactor are also discharged.

Prior to final shipment, the DRI pellets are screened to remove fines. This screening process generates particulate matter emissions. Removal and control of air borne particulate is also subject to BACT analysis.

Finally, the DRI fines collected from the screening operation are transported to the Briquetting Mill. This transportation operation generates particulate matter emissions. Removal and control of air borne particulate is also subject to BACT analysis.

BACT DETERMINATION FOR PM_{10} EMISSIONS FROM FURNACE DEDUSTING

BACT analyses for $PM/PM_{10}/PM_{2.5}$
DRI-107 - DRI Unit No. 1 Furnace Dust Collection (EQT068)
DRI-207 - DRI Unit No. 2 Furnace Dust Collection (EQT085)
DRI-115 - Product Screen Dust Collection (EQT076)
DRI-116 - Screened Product Transfer Dust Collection (EQT077)

Step 1 – Identify Potential Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression

Step 2 – Eliminate Technically Infeasible Options

Fabric Filter (Baghouse):

Fabric filters are the standard in the iron and steel industry for most $PM_{10}/PM_{2.5}$ control applications. Baghouses often are capable of 99.5% removal efficiencies, and baghouse removal efficiency is relatively level across the particle size range. However, DRI particles are known to react with oxygen in the atmosphere, reoxidizing in an exothermic reaction. This reoxidation process frequently causes fires when the DRI material is improperly handled, particularly when freshly discharged from the furnace before being passivated. The nature of the DRI particulate being captured makes the application of a fabric filter to this source a significant safety hazard, and thus a baghouse is technically infeasible.

Electrostatic Precipitator:

ESP's are capable of 99.5% or higher particulate removal, however several factors preclude their application to control $PM_{10}/PM_{2.5}$ from DRI dust emissions. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature. ESPs are especially sensitive to the electrical resistivity of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for the control of concentrated DRI dust sources.

Wet Suppression:

Wet suppression acts to prevent dust generation through the wetting of materials, and to settle dust more quickly by wetting the particles in air. However, directly wetting the fresh DRI product would unacceptably damage product quality by accelerating oxidation of the metal content. This may also cause excessive heat at points downstream of the control point, such as the product silos, potentially causing fires due to the oxidation reaction.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Wet Scrubber – 99%
2. Cyclone – 80%

Potential control alternatives were reviewed for technical feasibility in controlling $PM_{10}/PM_{2.5}$ emissions from the furnace discharge. Nucor has identified the highest remaining control option to be the application of wet scrubbing. PM_{10} emissions can be reduced by up to 99% by this technology.

Step 4 – Evaluate Remaining Control Technologies

Wet Scrubber:

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, and may be most appropriate for specific materials. DRI is one such material where wet scrubbing is particularly appropriate, because the water of the scrubber is able to prevent fires in the control

device itself. Captured fines are oxidized safely in the scrubbing water, and removed from the water system at the water clarifier.
<u>Cyclones:</u>

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology is a high-energy wet scrubber achieving at least 99% control of $PM_{10}/PM_{2.5}$. Nucor will install a scrubber on the furnace discharge for DRI dust control.

STORAGE SILO DUST COLLECTION INCLUDING PRODUCT TRANSFERS

The finished DRI product is stored in silos in order to isolate it from weather. DRI contains both elemental iron and carbon, and can be reactive with the atmosphere. The reaction of oxygen with the product pellets can generate a significant amount of heat, creating the possibility of fires. In order to limit the material's contact with the atmosphere, the silos are kept under a pad of seal gas, which contains very little oxygen. The small amount of oxygen allows the surface of the pellets to oxidize slowly, "passivating" the product and allowing for safer handling and transport.

<u>BACT analyses for $PM/PM_{10}/PM_{2.5}$</u>

Source ID – Description (EQT #)
DRI-112 DRI Unit #1 Product Storage Silo Dust Collection (EQT0073)
DRI-212 DRI Unit #2 Product Storage Silo Dust Collection (EQT0090)

Step 1 – Identify Potential Control Technologies

1. Fabric Filter (Baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Wet Suppression
6. Hooded Conveyors and Enclosed Transfer Stations

Step 2 – Eliminate Technically Infeasible Options

Fabric Filter (Baghouse):

Fabric filters are the standard in the iron and steel industry for most $PM_{10}/PM_{2.5}$ control applications. Baghouses often are capable of 99.5% removal efficiencies, and baghouse removal efficiency is relatively level across the particle size range. However, DRI particles are known to react with oxygen in the atmosphere, reoxidizing in an exothermic reaction. This reoxidation process frequently causes fires when the DRI material is improperly handled, particularly when freshly discharged from the furnace before being passivated. The nature of the DRI particulate being captured makes the application of a fabric filter to this source a significant safety hazard, and thus a baghouse is technically infeasible.

Electrostatic Precipitator:

ESP's are capable of 99.5% or higher particulate removal, however several factors preclude their application to control $PM_{10}/PM_{2.5}$ from DRI dust emissions. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature. ESPs are especially sensitive to the electrical resistivity of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for the control of concentrated DRI dust sources.

Wet Suppression:

Wet suppression acts to prevent dust generation through the wetting of materials, and to settle dust more quickly by wetting the particles in air. However, directly wetting the fresh DRI product would unacceptably damage product quality by accelerating oxidation of the metal content. This may also cause excessive heat at points downstream of the control point, such as the product silos, potentially causing fires due to the oxidation reaction.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Wet Scrubber – 99%
2. Cyclone – 80%
3. Hood Conveyors and Enclosed Transfer Points – 95% (Conveyance only)

Potential control alternatives were reviewed for technical feasibility in controlling $PM_{10}/PM_{2.5}$ emissions from the furnace discharge. Nucor has identified the highest remaining control option to be the application of wet scrubbing. $PM_{10}/PM_{2.5}$ emissions can be reduced by up to 99% by this technology.

Step 4 – Evaluate Remaining Control Technologies

Wet Scrubber:

High-energy wet scrubbers are technically feasible and achieve good control efficiencies. Wet scrubbers are able to accommodate large volumes of gas with high moisture contents, and may be most appropriate for specific materials. DRI is one such material where wet scrubbing is particularly appropriate, because the water of the scrubber is able to prevent fires in the control device itself. Captured fines are oxidized safely in the scrubbing water, and removed from the water system at the water clarifier.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed, due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream.

Hooded Conveyors and Enclosed Transfer Stations:

Hooded conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Hooded conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates or grain.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology is a high-energy wet scrubber achieving at least 99% control of $PM_{10}/PM_{2.5}$. Additionally, hooded conveyors and enclosed transfer stations will be installed to limit emissions from material handling. Nucor will install a scrubber on the product storage silos for DRI dust control.

BACT DETERMINATION FOR THE HOT FLARE

The reducing furnace must run as close to steady state operation as possible in order to produce product of acceptable quality. Due to the nature of the reducing gas recycle system periodic shifts in pressure may occur. The pressure of the reducing gas must be maintained below that of the seal gas system or an uncontrolled release of reducing gas will result from the top seal and the bottom seal. To maintain this condition, the reducing gas is occasionally flared to prevent a rise in pressure. The Hot Flare prevents an uncontrolled release of carbon monoxide from the system by combusting the reducing gas.

BACT analyses for PM/PM_{10}/$PM_{2.5}$
DRI-110 - DRI Unit No. 1 Hot Flare (EQT071)
DRI-210 - DRI Unit No. 1 Hot Flare (EQT088)

Step 1 – Identify Potential Control Technologies

The reducing gas contains incombustible particulate matter in the gas stream as gas is recycled from the shaft furnace. Therefore, the control of particulate from the hot flare is best addressed by cleaning of the reducing gas prior to its combustion. Particulate matter cleaning of the spent reducing gas has already been addressed, so BACT for PM is venting to the Hot Flare after the spent reducing gas has been cleaned by the wet scrubbers described as BACT for the Reformer Flue Gas. The flare shall be of the continuous pilot variety, fueled by natural gas.

1. Good Combustion Practices

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices - 50%

A review of the potential control options, and combination of options, was conducted to identify the most effective strategy for controlling PM_{10}/$PM_{2.5}$ emissions from the combustion of natural gas. Nucor has identified good combustion practices as the most effective and technically feasible control option.

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Good combustion practices can be effective at reducing PM_{10}/$PM_{2.5}$ emissions generated from the incomplete combustion of hydrocarbon fuels, because the technique limits both the filterable and condensable fractions of particulate emissions. Because of this property unique to the control technology set, and the fact that the majority of particulates generated by natural gas combustion are condensable, good combustion practices ranks the highest of the identified control technologies.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling $PM_{10}/PM_{2.5}$ from the natural gas pilot is good combustion practices. Nucor will maintain good combustion practices at the hot flare to control the generation of $PM_{10}/PM_{2.5}$ emissions due to incomplete combustion of natural gas.

BACT analyses for NO_X
DRI-110 - DRI Unit No. 1 Hot Flare (EQT071)
DRI-210 - DRI Unit No. 1 Hot Flare (EQT088)

Step 1 – Identify Potential Control Technologies

1. Low NO_x Fuel Combustion

Low NO_X Fuel Combustion:

A low-NO_X fuel is one which results in a lower generation rate of NO_X over traditional fossil fuels, on an equal energy basis. DRI reducing gas is a low-NO_X fuel, generating less NO_X per unit of energy as natural gas. This property is due to the low-BTU value of reducing gas, which burns at a cooler temperature, preventing the formation of much of the NO_X seen with hotter natural gas combustion.

Step 2 – Eliminate Technically Infeasible Options

None of the identified control technologies are technically infeasible for the control of NO_X emissions from the hot flare. None of the technologies have been eliminated based on technical concerns.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Low NO_X Fuel Combustion – 50%

Step 4 – Evaluate Remaining Control Technologies

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
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Low NO_X Fuel Combustion:

Low NO_X fuel combustion is the only identified and feasible control for NO_X from a process flare. The combustion of reducing gas is inherently a lower NO_X emitting process than a reference fuel such as natural gas.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling emissions of NO_X from the hot flare is the inherent low-NO_X combustion properties of the reducing gas.

BACT analyses for SO_2
DRI-110 - DRI Unit No. 1 Hot Flare (EQT071)
DRI-210 - DRI Unit No. 1 Hot Flare (EQT088)

Although emissions of SO_2 are subject to BACT controls as part of the wider Nucor Steel Louisiana facility, emissions of SO_2 from the hot flare are quite small at less than 0.1 tons per year. There are no control technologies that can be identified for the control of sulfur emissions from a process flare, and no technology could reasonably be considered to be cost effective when controlling such a minor source of emissions. BACT for SO_2 emissions from the hot flare has been selected as no feasible control.

BACT analyses for CO
DRI-110 - DRI Unit No. 1 Hot Flare (EQT071)
DRI-210 - DRI Unit No. 1 Hot Flare (EQT088)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices

Good Combustion Practices:

Good combustion practices are used to reduce emissions of CO, as well as other pollutants, by optimizing conditions in the combustion zone of a fuel burning source. CO emissions from the burning of fuels are usually due to the incomplete combustion of hydrocarbon fuel or a carbon monoxide-bearing fuel stream. Good combustion practices typically entail introducing the proper ratio of combustion air to the fuel, maintaining a minimum temperature in the firebox of the combustor, or a minimum residence time of fuel and air in the combustion zone. By employing good combustion practices CO emissions may be greatly reduced.

Step 2 – Eliminate Technically Infeasible Options

All of the identified control strategies are technically feasible, and none have been eliminated.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good Combustion Practices - 50%

Step 4 – Evaluate Remaining Control Technologies

Good Combustion Practices:

Good combustion practices can be effective at reducing CO emissions generated from the incomplete combustion of carbon monoxide fuels, because the technique maximizes combustion within the device. The hot flare will combust reducing gas, which contains a significant portion of carbon monoxide.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available technology for controlling CO emissions from the hot flare is good combustion practices. Nucor will install a flare tip employing good combustion practices to control the generation of CO emissions due to incomplete combustion of reducing gas.

B. ANALYSIS OF EXISTING AIR QUALITY

Prevention of Significant Deterioration regulations require an analysis of existing air quality for those pollutants emitted in significant amounts from a proposed facility. The analysis of ambient air impacts was conducted through air dispersion modeling usually AERMOD. Based on estimated maximum potential emissions, the proposed plant will be subject to Prevention of Significant Deterioration (PSD) review for SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$.

Based on the initial screening modeling, which considered emissions only from the DRI facility, maximum ground level concentrations of NO_2, SO_2, CO, and Pb are below the ambient significance levels and preconstruction monitoring exemption levels. Therefore, no preconstruction monitoring, increment analysis, or refined modeling is required for these pollutants. PM_{10} and $PM_{2.5}$ were above the modeling significance levels; therefore, refined modeling was conducted for these pollutants. The refined modeling demonstrated compliance with the NAAQS and PSD increment at all receptor locations.

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Consolidated Environmental Management Inc - Nucor Steel Louisiana
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NAAQS Analysis

Pollutant	Averaging Period	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration	National Ambient Air Quality Standard (NAAQS)	Calculated Maximum Ground Level Concentration (all sources plus background)
$PM_{2.5}$	24-hour	1.2 μg/m³	0.65 μg/m³	35 μg/m³	25.9 μg/m³ [a]
$PM_{2.5}$	Annual	0.3 μg/m³	2.2 μg/m³	15 μg/m³	11.3 μg/m³ [a]
PM_{10}	24-hour	5 μg/m³	7.8 μg/m³	150 μg/m³	106.9 μg/m³ [a]
PM_{10}	Annual	1 μg/m³	2.4 μg/m³	50 μg/m³	46.7 μg/m³ [a]
SO_2	1-hour	8 μg/m³	2.6 μg/m³	195 μg/m³	- [b]
SO_2	3-hour	25 μg/m³	1.2 μg/m³	1,300 μg/m³	- [b]
SO_2	24-hour	5 μg/m³	0.03 μg/m³	365 μg/m³	- [b]
SO_2	Annual	1 μg/m³	0.05 μg/m³	80 μg/m³	- [b]
NO_2	Annual	1 μg/m³	0.46 μg/m³	100 μg/m³	- [b]
NO_2	1-hour	7.5 μg/m³	7.45 μg/m³ [c]	195 μg/m³	- [b]
CO	1-hour	2000 μg/m³	11.5 μg/m³	40,000 μg/m³	- [b]
CO	8-hour	500 μg/m³	21.5 μg/m³	10,000 μg/m³	- [b]
Lead	3 month rolling avg.	-	0.001 μg/m³	0.15 μg/m³	- [b]

[a] Results of the refined modeling, considering all sources plus background concentrations.
[b] Refined modeling was not required for these pollutants.
[c] This represents the result of modeling performed using both DRI and Pig Iron facility sources.

Class II PSD Increment Analysis

Pollutant	Averaging Period	Allowed Class II PSD Increment	Modeled Class II Increment
PM_{10}	24-hour	30 μg/m³	24.8 μg/m³
	Annual	17 μg/m³	-12.4 μg/m³

Note: PSD increments for $PM_{2.5}$ will not be effective until October 20, 2011 (75 FR 64864).

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C. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ANALYSIS

Because the maximum modeled PM_{10} and $PM_{2.5}$ concentrations exceeded the PSD significance level, refined NAAQS modeling was required. The refined modeling demonstrated compliance with both the NAAQS at all receptor location.

Pollutant	Averaging Period	Background Concentration	Total Maximum Ground Level Concentration	National Ambient Air Quality Standard (NAAQS)
$PM_{2.5}$	24-hour	19.3 μg/m³	25.9 μg/m³	50 μg/m³
$PM_{2.5}$	Annual	9.6 μg/m³	11.3 μg/m³	150 μg/m³
PM_{10}	24-hour	60 μg/m³	106.9 μg/m³	15 μg/m³
PM_{10}	Annual	33 μg/m³	46.7 μg/m³	31 μg/m³

D. PSD INCREMENT ANALYSIS

Because the maximum modeled PM_{10} and $PM_{2.5}$ concentrations exceeded the PSD significance level, refined NAAQS modeling was required. The refined modeling demonstrated compliance with the Class II PSD increment levels at all receptor location.

Pollutant	Averaging Period	Allowed Class II PSD Increment	Modeled Class II Increment
PM_{10}	24-hour	30 μg/m³	24.8 μg/m³
	Annual	17 μg/m³	-12.4 μg/m³

A summary of the air quality analyses is also presented in Table II.

E. SOURCE RELATED GROWTH IMPACTS

Operation of this facility is not expected to have any significant effect on residential growth or industrial/commercial development in the area of the facility. No significant net change in employment, population, or housing will be associated with the project. As a result, there will not be any significant increases in pollutant emissions indirectly associated with Consolidated Environmental Management Inc's proposal. Secondary growth effects will include temporary construction related jobs. Approximately 150 new permanent jobs will be created during Phase I with an additional 100 jobs when Phase II is completed.

F. SOILS, VEGETATION, AND VISIBILITY IMPACTS

There will be no significant impact on area soils, vegetation, or visibility.

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G. CLASS I AREA IMPACTS

Louisiana's Breton Wildlife Refuge, the nearest Class I area, is over 100 kilometers from the site, precluding any significant impact.

H. TOXIC EMISSIONS IMPACT

The selection of control technology based on the BACT analysis included consideration of control of toxic emissions.

A modeling analysis for toxic air pollutants was also submitted. The modeling analysis was conducted using AERMOD. The modeling demonstrates that all modeled toxic pollutants are below the respective Louisiana ambient air standards (AAS). As the modeling indicated impacts below 7.5% of the AAS for each pollutant modeled, cumulative modeling with outside sources was not required.

Pollutant	Averaging Period	Calculated Maximum Ground Level Conc.	AAS
Ammonia	8-hour	1.32	640 $\mu g/m^3$
Barium	8-hour	0.0011	11.90 $\mu g/m^3$
Formaldehyde	Annual	0.0013	7.69 $\mu g/m^3$
n-Hexane	8-hour	0.43	4190 $\mu g/m^3$
Nickel	Annual	0.00004	0.21 $\mu g/m^3$
Zinc	8-hour	0.007	119 $\mu g/m^3$

V. CONCLUSION

The Air Permits Division has made a preliminary determination to approve the construction of the Direct Reduction Iron Plant at the Consolidated Environmental Management Inc - Nucor Steel Louisiana near Convent in St. James Parish, Louisiana, subject to the attached specific and general conditions. In the event of a discrepancy in the provisions found in the application and those in this Preliminary Determination Summary, the Preliminary Determination Summary shall prevail.

SPECIFIC CONDITIONS

Consolidated Environmental Management Inc - Nucor Steel Louisiana
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1. Comply with the Louisiana General Conditions as set forth in LAC 33:III.537. [LAC 33:III.537]

2. The permittee is authorized to operate in conformity with the specifications submitted to the Louisiana Department of Environmental Quality (LDEQ) as analyzed in LDEQ's document entitled "Preliminary Determination Summary" dated November 8, 2010, and subject to the following emissions limitations and other specified conditions. Specifications submitted are contained in the application and Emission Inventory Questionnaire dated August 20, 2010, along with supplemental information dated September 24, 2010 and October 22, 2010.

MAXIMUM ALLOWABLE EMISSIONS RATES

ID No.	Description		PM_{10}	SO_2	NO_X	CO	VOC
Iron Oxide Storage and Handling	DRI-101, DRI-102, DRI-105, DRI-201, DRI-202, DRI-205	gr/dscf	0.002				
Iron Oxide Coating Bin	DRI-103, DRI-203	gr/dscf	0.02				
Iron Oxide Fines Storage and Handling	DRI-104, DRI-204	Specific Condition	# 3				
Cooling Towers	DRI-113, DRI-114, DRI-213, DRI-214	milligrams/liter TDS	≤1000				
		Specific Condition	# 4				
Product Fines Briquetting	DRI-117	gr/dscf	0.0022				
Product Loading	DRI-118	Specific Condition	# 3				
Package Boiler	DRI-109, DRI-209	lb/MM Btu			0.00324	0.039	
		gr/dscf	0.0046				
		Specific Condition		# 6			# 7
Reformer / Main Flue Gas Stack	DRI-108, DRI-208	lb/MM Btu		0.002	0.0070	0.040	
		gr/dscf	0.0027				
		Specific Condition		# 6			# 7

Acid Gas Absorption Vent	DRI-111, DRI-211	tpy	0.31	2.12		2.62	
Upper Seal Gas Vent	DRI-106, DRI-206	tpy	0.26	0.08	2.84	2.03	
Furnace Dedusting	DRI-107, DRI-207	lb/MM Btu gr/dscf	 0.002		0.070	0.040	
Product Storage Silo	DRI-112, DRI-212	lb/MM Btu gr/dscf	 0.002		0.070	0.040	
Product Storage and Handling	DRI-115, DRI-116,	lb/MM Btu gr/dscf	 0.002				
Hot Flare	DRI-110, DRI-210	Specific Condition		# 6		# 7	# 7

3. BACT is selected to be implementation of wet suppression of dust generating sources by water sprays at each storage pile site.

4. BACT is selected to be a combination of less than 1,000 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

5. A high energy wet scrubber with a minimum of 90% control efficiency on the transfer operation for Loading DRI product into barges was determined as BACT.

6. BACT for SO_2 from natural gas combustion is to purchase natural gas containing no more than 2000 gr of Sulfur per MM scf for the Package Boilers and the Reformer.

7. BACT for CO and VOC is selected to be good combustion practices during the operation.

8. All emission limitations, monitoring, recordkeeping, and reporting requirements of Permit No. 2560-00281-V0 related to TSP/PM_{10}/$PM_{2.5}$, SO_2, NO_X, CO, and VOC emissions are also terms and conditions of this PSD permit.

TABLE I: BACT COST SUMMARY

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Control Alternatives		Availability/ Feasibility	Negative Impacts (a)	Control Efficiency	Emissions Reduction (TPY)	Capital Cost ($)	Annualized Cost ($)	Cost Effectiveness ($/ton)	Notes
Source ID – Description (EQT #) N/A									
Pollutant	Description of Alternative Control #1								
	Description of Alternative Control #2								
Pollutant	Description of Alternative Control #1								
	Description of Alternative Control #2								
Source ID – Description (EQT #)									
Pollutant	Description of Alternative Control #1								
	Description of Alternative Control #2								
Pollutant	Description of Alternative Control #1								
	Description of Alternative Control #2								
Notes: a) Negative impacts: 1) economic, 2) environmental, 3) energy, 4) safety									

TABLE II: AIR QUALITY ANALYSIS SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
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Pollutant	Averaging Period	Preliminary Screening Concentration ($\mu g/m^3$)	Level of Significant Impact ($\mu g/m^3$)	Significant Monitoring Concentration ($\mu g/m^3$)	At the Monitoring Station: Monitored Values ($\mu g/m^3$)	At the Monitoring Station: Modeling results ($\mu g/m^3$)	Background ($\mu g/m^3$)	Maximum Modeled Concentration ($\mu g/m^3$)	Modeled + Background Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Modeled PSD Increment Consumption ($\mu g/m^3$)	Allowable Clas II PSD Increment ($\mu g/m^3$)
$PM_{2.5}$	24-hour	2.2	1.2	-	19.3	NR	19.3	6.3	25.9	35	NR	-
	Annual	0.65	0.3	-	9.6	NR	9.6	2.0	11.3	15	NR	-
PM_{10}	24-hour	7.8	5	10	60	NR	60	46.9	106.9	150	24.8	30
	Annual	2.4	1	-	33	NR	33	13.7	46.7	50	-12.4	17
SO_2	1-hour	2.6	8	-	NR	NR	NR	NR	NR	195	NR	-
	3-hour	1.2	25	-	NR	NR	NR	NR	NR	1300	NR	512
	24-hour	0.03	5	13	NR	NR	NR	NR	NR	365	NR	91
	Annual	0.05	1	-	NR	NR	NR	NR	NR	80	NR	20
NOx	1-hour	7.45	7.5	-	NR	NR	NR	NR	NR	189	NR	-
	Annual	0.46	1	14	NR	NR	NR	NR	NR	100	NR	25
CO	1-hour	21.5	2000	-	NR	NR	NR	NR	NR	40,000	NR	-
	8-hour	11.5	500	575	NR	NR	NR	NR	NR	10,000	NR	-
Lead	3-month	0.001	-	0.1	NR	NR	NR	NR	NR	1.5	NR	-

NR = Not required.